ELECTRICAL WORLD

A consolidation of Electrical World, Electrical Engineer and American Electrician

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Electrified lift bridge Welland Canal

DECEMBER 27, 1930

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VOLUME 96 . . . NUMBER 26

News of the Industry 1155

Supervisory for San Antonio 1166
BY BRYAN GOUGER, *San Antonio Public Service Company*

Vertical A.C. Networks for Tall Buildings 1174

Economy of Ground Area in City Substation 1176

Group Lighting for Industries 1180
BY J. M. KETCH, *General Electric Company*

Favors Electric Furnaces for Special Steels 1184

Editorials 1163
Stabilizing Employment 1169
Natural Gas and Oil as Utility Fuel 1170
Deepwater Experience Amplified 1171
Reliability Dictates Design of Network Vault 1173
Variability of "Normal" Eyes Important Lighting Factor ... 1177
Portable Kenetron Housing Design 1178
The Chief Menace 1178
Flexible Connections Facilitate Maintenance 1179
Flow Meters for Multiple Services 1179
New Control-Cable Standard Based on Practical Needs ... 1182
Bolt-Contact Resistance Reduced 75 per Cent 1186
Financial and Statistical 1191
New Equipment 1198

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ELECTRICAL WORLD

for the Week Ending

December 27, 1930

Bonner, Russell and King depart, new Power Commission in

Supreme Court judges disqualified in Georgia rate case

It is no time for turning our backs either because we are afraid to face the issue or because we do not know how to face the issue. What our industry calls for today is courageous action, intelligent action, persistent action, widespread action.

HARRY REID
Chairman Public Relations
National Section, N.E.L.A.

—**Final interstate-power report** of Federal Trade Commission shows the much-debated figure on the rise. Somewhere between 15 and 20 per cent is its estimate, depending on whether imports or exports are counted—*p. 1160.*

—**Plan to stabilize employment** as part of a comprehensive program for peace and security of mind of General Electric workers outlined by Gerard Swope. Unemployment specter but one of the ghosts to be laid—*p. 1169.*

—**Another vertical substation.** After deciding to utilize a small area facing on one of Chicago's busiest streets as a substation site, engineers cleverly combined economies, safety, appearance and good engineering—*p. 1176.*

—**Network idea spreads further** as Pacific Coast engineers incorporate plan in improved form on basis of earlier skyscraper electrification work in the East—*p. 1174.*

—**New York's rate case drifts** to prolonged presentations of long-contentious questions in spite of Commission Chairman Maltbie's avowed intention of making it short and snappy. Just another rate case?—*p. 1157.*

—**Georgia judges disqualified** to sit in Crisp County case of Georgia Power Company because of security ownership. Governor must make some special selections to permit hearing by supreme tribunal of state—*p. 1158.*

—**Supervised substation control** proves value to San Antonio utility. Maintenance costs and labor fully justified by improved service rendered, in opinion of company engineer—*p. 1166.*

—**Deepwater experience data** amplified by late operating report. Bin system advantages emphasized. 1,200-lb. pressure economics increase to 12,244 B.t.u. per kilowatt-hour—*p. 1172.*

NEWS

OF THE WEEK

New Power Commission in Office—All Nominees Confirmed

WITH the swearing in of Dr. George Otis Smith, Colonel Marcel Garsaud and Claude L. Draper at 3 p.m. December 22, the reorganized Federal Power Commission came into existence. Commissioners McNinch and Williamson will not be sworn in until their return to Washington after the holidays.

Confirmation of Chairman Smith, Commissioner Garsaud and Commissioner McNinch was opposed on the floor of the Senate, but each was confirmed with a substantial majority. The vote on Commissioner Smith's confirmation was 38 to 22, the vote on Commissioner McNinch 46 to 11, and that on Commissioner Garsaud 42 to 14. In the case of Commissioners Smith and Garsaud the vote against them came largely from the insurgent group. With the exception of Senator Frazier of North Dakota, all those voting against Commissioner McNinch were Democrats.

In urging the Senate not to confirm Dr. Smith, Senator Dill of Washington said that the nominee was so anxious to prove to the committee that he was not in favor of municipal ownership of utilities that he leaned over backward on the proposition. Senator Dill stated that he had no desire to see a commission made up wholly of men who believe in municipal ownership, but that the law gives preferential rights to municipal applicants and he feared that Dr. Smith would not be fair to them. Senator Dill said that long service in the government had imparted to Dr. Smith the bureaucratic spirit and the bureaucratic tendency of being arbitrary in his decisions. He expressed the opinion that Dr. Smith was unfitted by temperament and by his attitude for the place.

Debate took place also on the confirmation of Messrs. Garsaud and McNinch, in the course of which Senator Morrison of North Carolina defended the Duke Power Company.

Bonner, Russell and King are all out of the picture

Long-existing contention between subordinates of the Federal Power Commission was brought to a summary end this week, the first important action of the new board, taken by the three members sworn in on Monday, being to drop Charles A. Russell, solicitor, and William V. King, chief accountant, from the staff, and to accept the resignation of Frank E. Bonner, executive secretary. To Mr. Bonner, however, as well as to Mr. Russell and Mr. King, Chairman Smith handed a letter asking him not to apply for reappointment.

Mr. Bonner, who has frequently been under senatorial fire as an alleged devotee of power-company interests, had previously intimated that his resignation was impending, as recorded last week. The office of executive secretary comes to an end with the inauguration of the new board, which will appoint a regular secretary, presumably to be a less important factor in the commission's proceedings than were Mr. Bonner and his predecessor, O. C. Merrill.

Messrs. Russell and King, as recorded in previous issues, were instrumental in contesting the pre-license costs of a number of hydro-electric companies, Mr. King disputing many millions included in the company statements and Mr. Russell supporting him. Mr. Russell also protested vigorously against the finding of Attorney-General Mitchell that the jurisdiction of the commission over non-navigable branches of navigable streams is limited. This interpretation, Russell maintained would destroy the water-power act.

Radical senators protested loudly when they heard of the dismissal of Messrs. Russell and King, and talk at once arose of a reconsideration of the confirmation of the Power Commission nominees when Congress reassembles after the Christmas holidays.

With the three exceptions noted, all the commission employees will be kept on, at least temporarily.

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POWER COMMISSIONERS TAKE OATH OF OFFICE

—Henry Miller News Picture.

Percy F. Ellett of the State Department inducts (left to right) Claude L. Draper, George Otis Smith and Marcel Garsaud

Haig and McGrath Issue St. Lawrence Statement

FOLLOWING A CONFERENCE at Toronto between the members of the St. Lawrence Power Development Commission of New York State and the members of the Hydro-Electric Power Commission of Ontario, Chairman R. M. Haig of the former body and Chairman C. A. McGrath of the latter issued a joint statement reading:

Here is a joint asset which offers great possibilities for Ontario, the Dominion, New York and the United States. Great potential power is going to waste daily. We have made great progress today in understanding each other. Although no definite commitments could be made, a very cordial entente between the two public bodies has been established. The engineers of the bodies will continue to confer on the engineering plans.

▼

Nebraska Municipalities Weigh Their New Powers

REPRESENTATIVES OF MOST of the 150 Nebraska municipalities operating light and power plants met recently in Lincoln to consider ways and means to make effective use of the new powers conferred on them by the law adopted at the November election. Most of the cities reported surplus funds on hand sufficient to enable them to make rural extensions at the present time, and engineers present submitted estimates of costs for various types of construction.

Feasibility of "hook-ups" between municipal plants whereby alternate twelve- and twenty-four-hour operation could be used to cut costs was also discussed. Grand Island and Hastings, 25 miles apart, are negotiating on this basis. Attorney-General Sorensen, protagonist of the new law, predicted that within a few years Nebraska will be widely known as a state where cheap power is obtainable and that hundreds of new factories and industries will be attracted to it. He attacked private companies as suffering from overcapitalization, and argued that they cannot compete in rates with public plants with their lower costs of borrowing.

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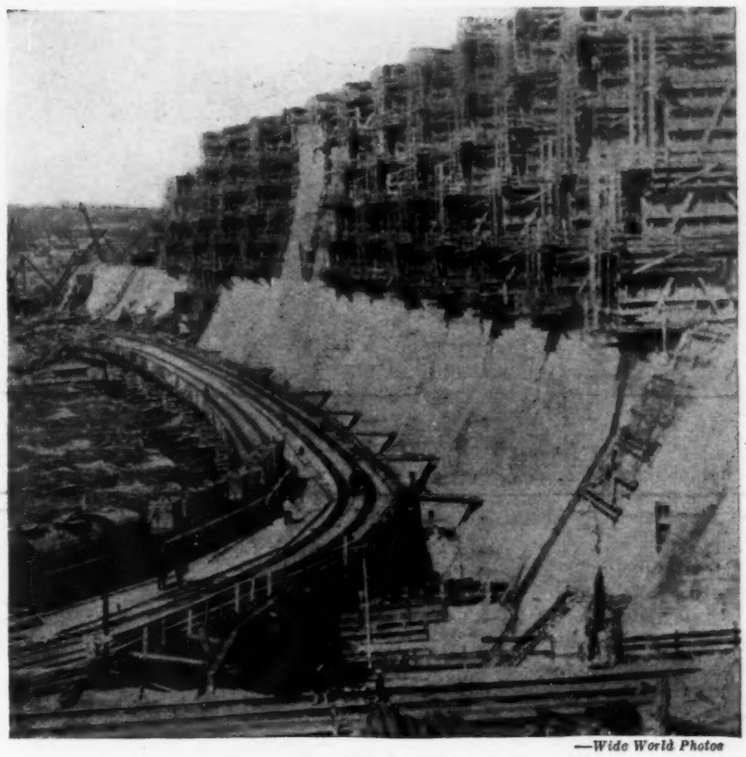
Hearings Drag Along on New York Edison Rates

OBJECTION TO THE proposed demand charge of $1 a month for commercial customers of the New York City associated light and power companies was voiced by Charles S. Reed, rate specialist for the Real Estate Board, when the New York Public Service Commission resumed its hearings on the companies' new tariff on December 18. Mr. Reed did not object to the charge in theory, he said, but opposed it as applied in the proposed rate structure, because of the expense of installing demand-charge meters and because the proposed rate did not give sufficient reduction to customers with good load factors. A demand charge, he maintains, should be optional with the consumer and based on yearly, not monthly, demands.

Similar objections were made on the following day by Ralph Dudley, a member of a submetering firm, who disclosed that he had just organized the Dudley Power Corporation to manufacture and distribute electrical energy within a city block where, it was contended, a city franchise would not be necessary since the company's conduits would not cross streets.

Much cross-examination by counsel followed the witnesses' testimony. Chairman Maltbie found fault with a pamphlet issued by a taxpayers' association on the ground that it was so printed as to convey the idea to casual readers that Mr. Maltbie had fathered it. The hearings were adjourned to January 14.

RUSSIA'S HYDRO DEVELOPMENT TAKING SHAPE



—Wide World Photos

A recent photograph of the Dnieper River dam shows substantial progress on the great undertaking, designed to help industrial revolution in the Soviet domain, for which the generating units are under construction in the United States.

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Hell Gate Installs Two New Boilers

TWO NEW BOILER UNITS, which, with the building in which they are housed, coal-pulverizing mills and other auxiliaries, were built at a cost of $5,000,000, have just been put into service in New York City by the United Electric Light & Power Company at its Hell Gate generating station, which has a rating of 694,000 kva.

These boilers, manufactured by the Babcock & Wilcox Company, supply steam to drive one of the 160,000-kw. turbo-generators installed some time ago. Each boiler has a nominal rating of 800,000 lb. of steam per hour at a temperature of 725 deg. F. and 275 lb. pressure. They have many new features of design. All fans, mills, feeders and dampers are controlled from a central operating board, thus centralizing the control to an extent said never before to have been attempted. At maximum capacity there is burned in the furnace for each boiler about 100,000 lb. of coal per hour, and the output exceeds 1,000,000 lb. of steam per hour. The furnace ash is discharged periodically in molten form.

Crisp County Case Is Postponed at Atlanta

DISQUALIFICATION OF ALL BUT ONE of the judges of the Georgia Supreme Court who were last week to hear the appeal of the Georgia Public Service Commission against the injunction now restraining it from holding a hearing at which it would require the Georgia Power Company to show cause why the reductions offered by the latter to consumers in the territory of the Crisp County publicly owned plant should not be extended to other districts served by the company has forced the postponement of the hearing. Ownership of Georgia Power Company stock was a chief reason for the disqualification. The Governor of the state is expected to select judges especially to hear this case after the first of the year.

At a meeting of city officials and users of electric power at Albany, Ga., last week, a movement to "wipe out the present disparity in industrial power rates unfavorable to south Georgia" was initiated by several south Georgia communities. Speakers said they thought that the Georgia Power and South Georgia Power companies desired to wipe out discrimination.

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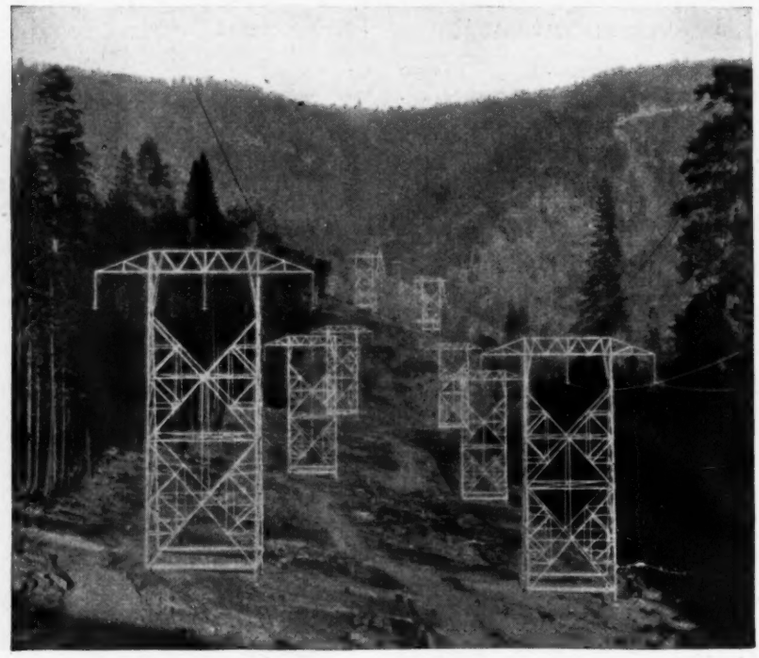
Southwestern Network Continues to Grow

A 110-KV. TRANSMISSION LINE across the Mississippi River at Memphis as an important connecting link in interconnected service is planned by the Memphis Power & Light Company, consent of army engineers and the Mississippi River Commission being thought assured. Two steel towers, each approximately 400 ft. high, will support six cables with a span across the stream of 4,300 ft. and a minimum clearance above maximum high water of 75 ft. The line, which will cost $250,000, will join the transmission lines of the Arkansas Power & Light Company at Wynne, Ark.

The Louisiana Power & Light Company has placed in service its 110-mile, 110-kv. Amite-New Orleans transmission line, which interconnects its electric power systems in both northern and southeast Louisiana and the system of New Orleans Public Service, Inc. As a part of the Mississippi Power & Light Company's transmission system is used to complete this interconnection, the new line is tied in with the systems of the Louisiana Power & Light, New Orleans Public Service, Mississippi Power & Light, Arkansas Power & Light, Memphis Power & Light and West Tennessee Power & Light companies.

TIGER CREEK-NEWARK 220-KV. LINE BUILDING



It is two miles from the towers in the foreground to the angle towers in the background. In the upper right-hand corner is the penstock running to the Tiger Creek 60,000-kva. power house of the Pacific Gas & Electric's Salt Springs development on the Mokelumne River, Calif. From this plant 11,000 kva. will be available next July. To Newark substation the transmission distance is 127 miles.

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Fatality Raises Issue of Relative Liability

SUSTAINING THE FINDING made by a jury in a lower court, the Iowa Supreme Court has ruled that the Central States Electric Company was alone responsible for the death of a woman from contact with a wire fence which had become charged with electricity because of a broken transmission wire belonging to the company named. The energy carried by this line was generated by the Iowa Public Service Company, and in the suit that utility had been joined with the Central States company as responsible. It was shown, however, that the operator of the generating company had become aware of the existence of a ground on the system and that the transmission company had been duly notified. The latter asked that the sending of energy be continued, saying that it was storming so badly that a search for the break could not be immediately made. This was Friday night, and on Sunday the fatal accident occurred.

The chief question under review was whether the transmitting company was solely responsible for the accident. The high court held that this was a purely jury question and that the evidence supported the jury in absolving the generating company, which, having notified the transmitting company of the dangerous short circuit on the latter's line, was justified in continuing to supply electricity on the promise of the other to make repairs.

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Form Citizens' League to Back Los Angeles Bureau

ORGANIZATION OF THE Municipal Light and Power Defense League has been announced at Los Angeles, its purpose being to keep the public informed regarding the municipal system and to support its personnel against unwarranted attack. Franklin D. Howell is president. The league's first statement says: "It is our conviction that the city's municipal power system is one of the greatest assets of Los Angeles, saving money to the home owner, the renter, the merchant and the manufacturer and assisting in the establishment and growth of our factories by reason of the cheap rates for electricity that it makes possible."

Injunction Set Aside in Illinois Telephone Case

A DECREE AGAINST the enforcement of Chicago rates prescribed for the Illinois Bell Telephone Company by the Illinois Commerce Commission, granted by a federal district court in that state, has been set aside by the United States Supreme Court in order that, on rehearing, proper discrimination may be made between the interstate and the intrastate business of the company and that the effect which the rates in question would have had for each of the years since the commission's order (made in August, 1923) may be ascertained. In the meantime a restraining order will remain in force.

The lower court, following the commission's own precedent, made no specific findings based on a separation of the two classes of business but determined the issue on the basis of the total Chicago property of the company. This court arrived at a valuation of $125,000,000 as against the commission's figure of $96,000,000, most of the difference being accounted for by an item of $26,000,000 "taken for depreciation reserve and put into plant and equipment"—an item excluded by the commission on the ground that it was contributed by the subscribers of the company, but included by the court on the ground that the customers had paid for service, not for the property used to render it, and that profits of the past could not be used to sustain confiscatory rates in the future. More than $11,000,000 was tied up in a reserve fund on January 31 last for the possible recoupment of customers.

The Supreme Court in remanding the case stated that there should be findings on the appellant's contention that the Western Electric Company should virtually be regarded as the manufacturing department for the interstate telephone system and that net earnings from manufacture and sale of telephone equipment should be segregated from profits from other activities in ascertaining their specific effect on the operating company's expenses and the broader question of confiscatory rates. A similar instruction was conveyed by the ruling to the District Court in connection with the actual costs incurred by the parent company as establishing the reasonableness of the licensee payments, which have been decreased since 1926 from 4½ per cent to 4 per cent, then to 2 per cent and lately to 1½ per cent.

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Prize Awards Committee of N. E. L. A. Issues Data

A POSTER SHEET containing full particulars of the prize awards administered by the N.E.L.A. has been issued by the committee in charge, of which Frank W. Smith is chairman. These details may be obtained from headquarters at 420 Lexington Avenue, New York. In addition to the Doherty, Byllesby, Insull, McGraw and Davidson prizes for papers, the association will this year administer the Gilchrist award and the new Curtis award, both for accomplishments by companies or individuals in specified activities, and the Forbes public service cup.

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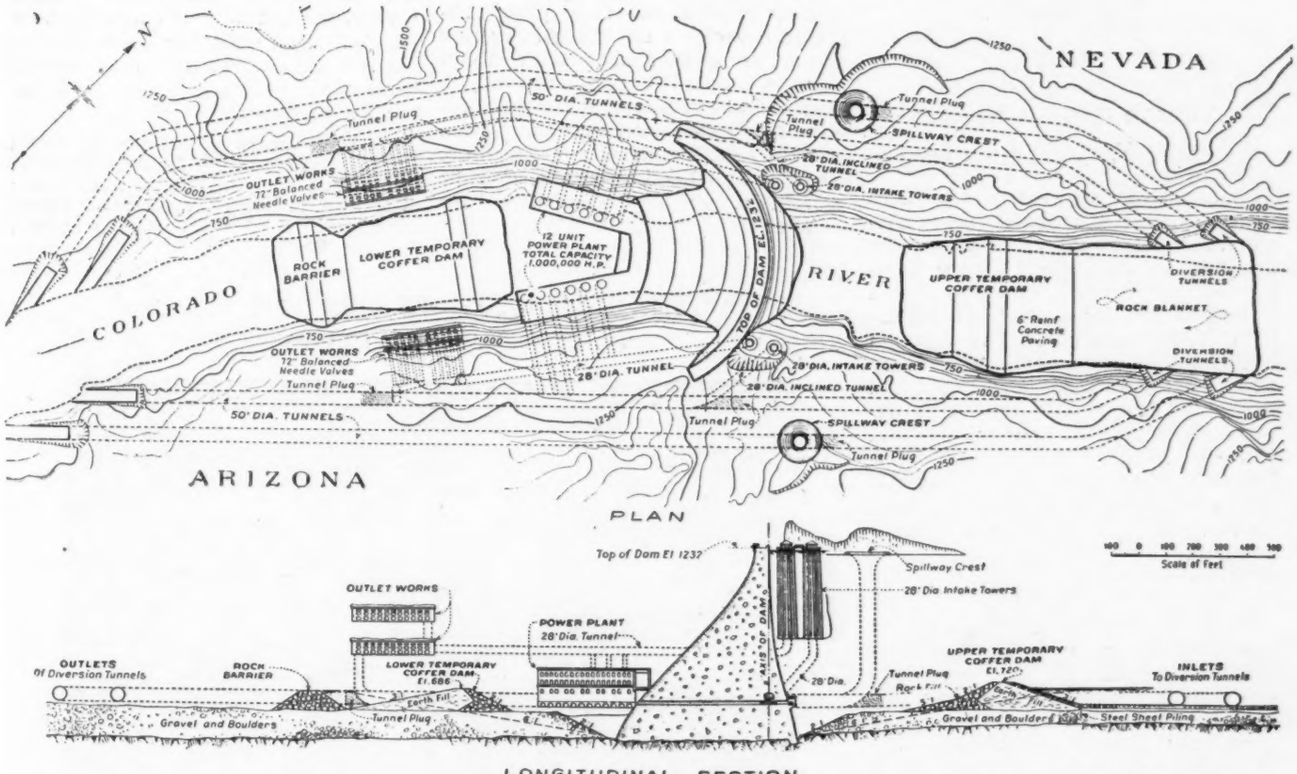
FROM PAPER TO CONCRETE HOOVER DAM WILL COST $108,800,000



—Reclamation Bureau Diagram.

Another step has been taken in the government's great water storage and power enterprise by Secretary Wilbur's announcement that bids on the construction contract will be opened on March 4. Work will start 30 days after the award. The All-American Canal will add $38,500,000 to above cost, and interest charges will swell the total to $165,000,000. (See ELECTRICAL WORLD *for November 15, page 895, and October 25, page 761.)*

ONE OUT OF MANY

All over the country Christmas trees for which electrical men are responsible have, as usual, blossomed. This living 3,000-bulb tree, in Times Square, is the gift of the Electrical Association of New York to the metropolis.

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Cameron and Zellerbach Alaska Projects Licensed

LICENSES COVERING IMPORTANT PROJECTS in Alaska for the large-scale manufacture of newsprint paper have been approved by the Federal Power Commission for George T. Cameron of San Francisco and for I. & J. D. Zellerbach of the same city. The Cameron application is pursuant to preliminary permits issued June 16, 1927, and June 5, 1930. It is proposed to develop 80,500 hp. on Long, Crater and Dorothy Lakes near Juneau. The license is to be subject to certain conditions which will be made by the Forest Service and to certain reservations as to items of pre-license costs. The Zellerbach license is pursuant to a preliminary permit issued June 16, 1927. It covers a 65,500-hp. installation on Mirror Lake and Fish Creek and on Ella, Manzanita, Grace, Swan and Orchard Lakes near Ketchikan, on Revillagigedo Island. Reservations were made in the case of this license also.

A minor-part license was authorized for the Hook-Aston Milling Company of Zanesville, Ohio, covering its constructed project at United States Dam No. 10 in the Muskingum River, Ohio. Another minor-part license was authorized for the Turlock and Modesto Irrigation District in California. The license covers the flooding, for power purposes, of public lands.

An application by R. D. Webb of Minden, La., for two power projects in Colorado was approved. One project is on the Lake Fork of Gunnison River, where it is proposed to install 3,300 hp., and the other is on the same stream and on Henson Creek, where it is proposed to install 26,000 hp. The authorization of the preliminary permit was approved with the understanding that the project be made subject to the Hoover Dam project and the Colorado River compact and subject to certain restrictions recommended by the Geological Survey.

A preliminary permit was authorized for Milton City, Ore., covering a proposed storage reservoir for use in connection with two constructed projects on the South Fork of Walla Walla River.

Permits also were authorized for small projects on Cottonwood and Lone Tree Creeks in California and on Glory Creek in Alabama.

Delay in authorizing the project of the Western Washington Electric Company in North River near Willipa, Wash., is due to the fact that the plan for the dam was not satisfactory. The commission was not willing to approve the arch-type dam as proposed in the original application. New plans submitted, covering a straight gravity type of dam, are under study. Delay in getting the construction work started has aroused local criticism where the work was being relied upon as a part of the program to relieve unemployment. More than $3,000,000 will be expended on the project, at which 40,000 hp. will be installed.

An application to the Federal Power Commission for a preliminary permit covering a project on the Mokelumne River has been made by the East Bay Municipal Utility District of Oakland, Cal. The proposed development is to consist of a dam, a reservoir and a power house at the Middle Bar site, just upstream from the applicant's Sancha Plana plant. It is planned to develop a head of approximately 100 ft. below the Electra plant of the Pacific Gas & Electric Company. Primary power to the extent of 4,100 hp. thus will be made available.

The Citizens' Light, Power & Gas Company of Ketchikan, Alaska, has applied for a preliminary permit at Lake Perseverance. It is proposed to build a dam at the outlet of the lake and to construct a tunnel extending to lower Ketchikan Lake, a distance of 6,000 ft. The water is to augment the supply which is at present available at the applicant's power house near Ketchikan.

▼

Percentage of Interstate Transmission Is 15 to 20

IN ITS FINAL REPORT to the Senate on the interstate movement of electrical energy, the gist of which was noted on page 1114 last week, the Federal Trade Commission summarized the national totals of generation and interstate transmission as follows:

Electrical energy generated in the United States in 1929 totaled 95,582,000,000 kw.-hr. Gross ratio of quantities exported across state lines to quantities generated during 1929 (for the 48 states and the District

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AGAIN THE NAVY SWEEPS THE SKIES— THIS TIME AT SAN PEDRO, CAL.

—*P. & A. Photos.*

of Columbia) was 15.18 per cent. Similar gross ratio of quantities imported to quantities consumed was 19.64 per cent. The difference between the two ratios is partly due to losses between points of generation and consumption, which reduce the total quantity received by consumers by as much as 15,000,000,000 kw.-hr. The size of the imports ratio is also affected by the fact that imports over international boundaries into the United States are 1,400,000,000 kw.-hr. in excess of exports. Aside from this difference between exports to and imports from Canada and Mexico, the aggregate for exports and imports across the boundaries between states are identical, since exports of one state are imports of another.

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Study of Power Lines in Relation to Airports

AS PART OF A BROAD STUDY concerning obstructions to the landing and taking off of airplanes the Airways Division of the United States Department of Commerce has communicated with the various state public utilities commissions on the subject of the proximity of power lines to airports and intermediate landing fields. The material assembled from this study will be laid before a meeting of those interested in uniform state aëronautical legislation in the first part of January.

It has been indicated from the replies received so far from utility commissions that most states do not concern themselves with whether or not power lines are constructed in the vicinity of airports. This is not the major question, however, according to airport engineers. The larger airports are laid out with considerable care and are removed from power lines, radio towers and neighboring buildings that would constitute a menace to taking off or landing.

Many of the emergency landing fields that are placed at intervals along heavily traveled airways have been more bothered by power lines. This is because these fields are not subject to the same scrutiny as terminal airports. Complaints have been received that power lines had been constructed along the sides of emergency landing fields after these fields have been placed in service. This is usually because power companies already had franchises for the construction of these lines but for some reason or other had delayed the actual work. It is felt by airport engineers that such conditions are brought about only by misunderstandings and that future difficulties can be eliminated through co-operation with the electrical engineers.

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Coming Meetings

American Engineering Council — Annual meeting, Washington, D. C., Jan. 15-17. L. W. Wallace, 26 Jackson Place, Washington.

National Electrical Manufacturers' Association — Midwinter meeting, New York headquarters, Jan. 19-23. A. W. Berresford, 420 Lexington Ave., New York.

American Institute of Electrical Engineers — Winter convention, New York, Jan. 26-30; district meeting, Pittsburgh, March 9-13. F. L. Hutchinson, 33 W. 39th St., New York.

North Central Division, N.E.L.A.— Commercial meeting, Nicollet Hotel, Minneapolis, Jan. 26 and 27; engineering meeting, Minneapolis, Feb. 23 and 24. J. W. Lapham, 803 Plymouth Bldg., Minneapolis.

Pacific Coast Electrical Association— Commercial Section, Los Angeles, Feb. 5-6. S. H. Taylor, 447 Sutter St., San Francisco.

Midwest Power Engineering Conference—Chicago, Feb. 10-13. G. E. Pfisterer, 308 W. Washington St., Chicago.

Oklahoma Utilities Association—Oklahoma City, March 10-12. E. F. McKay, 1020 Petroleum Bldg., Oklahoma City.

Illinois State Electric Association — Springfield, Ill., March 12 and 13. G. W. Schwaner, 205 Illinois Mine Workers' Bldg., Springfield, Ill.

Levitt Demands Free Rural-Line Extension

PROF. ALBERT LEVITT of Redding, Conn., who has conducted a single-handed fight to oust the members of the Public Utilities Commission of that state for their alleged failure to comply with the law governing removal of grade crossings (ELECTRICAL WORLD, July 19, page 99), has just appeared before the commission in a complaint brought by him against the Connecticut Light & Power Company because of its refusal to supply his farm home with electric service unless he paid the cost of the customer line, said to approximate $3,000, or guarantee a minimum usage far above what he considers reasonable.

"My point," said Professor Levitt, "is that if a utility company is a solvent, going concern, earning a reasonable return on its investment, it cannot compel a man who wants its service to pay for the cost of extension or guarantee a usage large enough to pay for the cost eventually. The company has a right to get and must get a 'reasonable return' on its entire system, not on each or any one point of it. The United States Supreme Court has so ruled. If that were not the case, the company would have to have separate rates for each customer. Of course, if a man lived so far away from others that to provide him with service would necessitate raising everybody else's rate to meet the expense, then the case would be different. The courts have ruled that a public utility company cannot pick and choose its customers."

KANSAS CITY P. & L. ERECTS TOWER

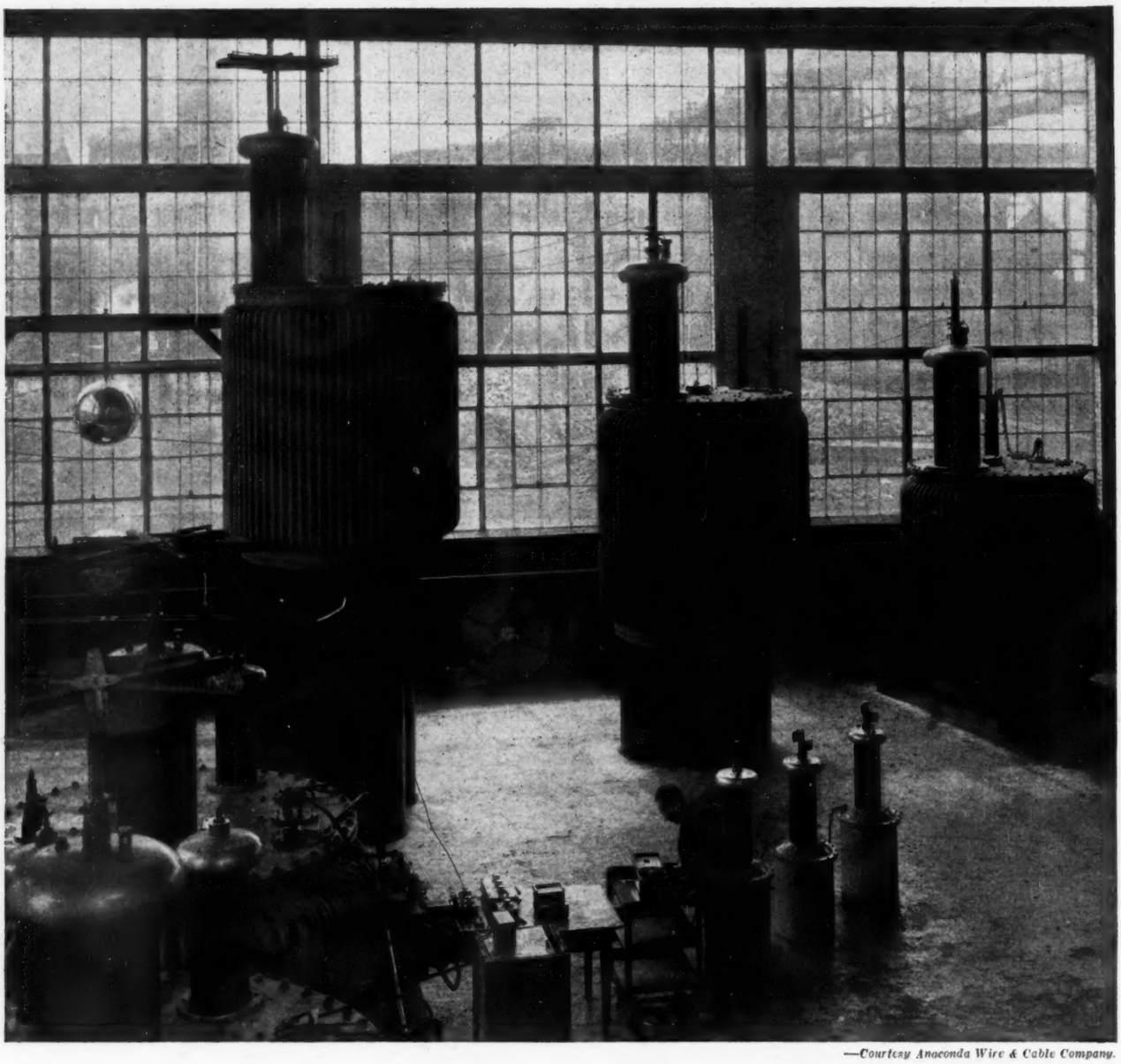
One of the highest and most ornamental office buildings in Kansas City is under way for the Kansas City Power & Light Company. The architect's plan, as finally adopted, is shown above.

▼

West Virginians Oppose New River Project

PROTESTANTS AGAINST the Cheat River water-power project carried their fight against the 1929 water-power act of West Virginia to the Public Service Commission of that state again on December 10 by a protest against the application of the West Virginia Power Company for a license on New River.

The protest stated that action by the commission in the New River case would embarrass the Kanawha County Circuit Court, where the Cheat River case is now pending, and would "seriously embarrass the Legislature in imposing restrictions upon future applicants for less desirable resources and sites." To grant the permit, the protest said, may result in a denial to the people of their right "to repeal, modify or correct" present water-power legislation.



—*Courtesy Anaconda Wire & Cable Company.*

750,000 Volts for Cable Testing

These three 150-kva., 250,000-volt transformers may be arranged for 750,000-volt series or 433,000-volt, three-phase operation to conduct breakdown tests, accelerated life tests or long-time ionization and hot-spot tests on all types of cables. In the foreground are three current transformers, insulated for high voltage, that may be used to load single-conductor cables up to 1,500 amp. or three-conductor cables up to 500 amp. per conductor, provided the voltage at which they are energized does not exceed 100,000 volts. These transformers are now being used to conduct cyclic long-time loading tests on cables at overvoltage to provide accelerated life data.

EDITORIALS

L.W.W.MORROW
Editor

Does congressional silence give consent?

IT IS encouraging to note that the Merchants' Association of New York declares for private development of water power. It is significant, however, that business men find it necessary to reaffirm their antipathy to government ownership. The case against government ownership and operation of electric utilities rests solidly on a conviction, born of experience, that consumer, taxpayer and industry alike benefit from having competent private ownership of the utilities. Private initiative and ownership are essential to progress.

But radical proposals in Congress and the shift toward government ownership and operation of Hoover Dam, Muscle Shoals and the St. Lawrence—three outstanding hydro projects—make it advisable to reaffirm publicly and aggressively the principles that have been found so satisfactory for the development of industry in this country. Not only business men but legislators should have the courage to speak out against the false gods set up in the legislative forum by the Norris-Brookhart-Walsh radical group. As Mr. Coolidge puts it: "The national budget is eloquent against war and against government in business." But there is need for more effective leadership to bring home the meaning of budget figures that indicate depleted treasuries.

Sane statesmen should realize and act upon the fact that the general campaign for public ownership and operation advocated by radicals in and out of Congress would be fatal not only to the utilities but to the interests of their millions of customers. Congressional leaders should reaffirm American principles of business development and give expression to the sound and well-tried opinions of those who know the danger of the radical program. The debate should not be one-sided. Silence as well as vituperation is sometimes a sign of intellectual weakness.

Britain faces facts

IN HIS recent book Sir Ernest Benn says that "Democracy, instead of being bribed by promises, must be told the truth"—the truth being that, notwithstanding popular fallacies, the state cannot maintain prosperity by taxation and the application of uneconomic principles, thus eliminating the necessity of mankind building its own prosperity by its own exertions. A recent pamphlet of the British Engineering and Allied Employees' National Federation supports this contention of Sir Ernest Benn's by pointing out that the present path toward destruction is being taken by Great Britain because people do not face economic facts.

Taxation of industry is pyramided, with the result that selling prices become prohibitive. Unemployment then follows, and the dole system plus more taxation accelerates the speed with which industry decays. Add to this government pressure on business to force the maximum amount of labor in industry and the minimum amount of consolidation and modernization, and a very good survey is had of the present British industrial situation. It is going from bad to worse.

Taxation is a necessary tool for government to use in support of its efforts to be a nation's fairy godmother, but it should never be forgotten that

taxation is a penalty on industry and on those who are trying to produce prosperity by their own efforts. An overdose of taxation is dangerous, and the present situation in Great Britain can be rectified only by popular recognition of the necessity for economy at the sources of wealth, the establishment of the maximum incentives for individual efforts and the application of sound economic principles.

No conflict between stock and cash dividends

THAT two large utility systems, American Water Works & Electric and Engineers' Public Service, have recently seen fit to abandon their stock-dividend policies and revert to the payment of cash on common stock does not signify any inherent defect in the stock dividend as such. Nor does it connote a trend away from that policy.

Rather than pay out cash to shareholders, six or seven of the large utility systems have found it advantageous to issue certificates as evidence that a portion of earnings otherwise available for cash dividends has been transferred from surplus to capital account and permanently invested in the industry. In this way a portion of new construction and expansion has been financed without the added cost occasioned by a public issue.

The advantage of such a policy has been especially evident during the period of greatest expansion in the industry. But there are few who do not believe this expansion will continue, even though at a lower annual rate of increase, for many years. The alleged danger of dilution in earnings through a continuation of the policy seems remote. So also does the risk of an unbalancing of capital structure through continuous issue of common stock. It must be said, however, that the success of the policy is predicated upon the ability to show a steady expansion annually.

There is obviously no "best policy," to fit all cases, in the distribution of income. Those companies which have abandoned the stock-dividend policy have had specific, and incidentally different, reasons for so doing. Those which still adhere to the stock-dividend policy—a group representing assets of around five billion dollars—have found the stock dividend more suitable to their particular situation. They have ample time to consider whether or not it is a fitting permanent policy.

N.E.L.A. prize awards on higher plane

THE National Electric Light Association has just announced the usual prizes to be awarded at the 1931 convention. Those to be awarded to individuals for outstanding papers on subjects relating to the electric light and power industry include the Doherty (general), Byllesby (accounting), Insull (public relations), McGraw (engineering) and Davidson (commercial) prizes. In addition there will be the usual awards to companies or individuals for outstanding accomplishment in specified activities, these being given by J. M. Gilchrist, Augustus D. Curtis and B. C. Forbes.

The awards have a very worthy purpose—to stimulate constructive thought and action in the advancement of the electric light and power industry. No doubt the judges have been very conscientious in selecting the prize winners, but in the past the caliber of some papers and activities which have received recognition has not been of that high degree of excellence which should be expected. This criticism is not directed at the thinking and action of the industry, but it is intended for the individuals and companies that might have reported meritorious accomplishments or policies but did not present them for consideration. If there is not real competition for recognition, the purpose of the awards is defeated, since many of the prize papers and activities will not represent outstanding accomplishment and therefore will establish no goal toward which others should strive.

This situation the N.E.L.A. prize awards committee recognizes, and we join it in urging more extensive competition. If papers and activities of sufficient merit are not submitted, it will be better to withhold awards. Indeed, in such an event, the committee will, it has decided, withhold awards next year, following a precedent set by B. C. Forbes in May, 1930. This will surely raise the competition to a higher plane.

Helping business help itself

SINCE every utility's business is dependent on the composite business in its territory, each electric light and power company has a selfish interest in the general welfare and prosperity of its community, and for this reason each utility is eager to be of aid in helping its business leaders out of the present depression.

From all that can be gleaned, about the only reason the nation is not on the road to recovery already is that the public as a whole is not spending the money it has as freely as it would under normal conditions. And the retrenchment of spending is due chiefly to uncertainty regarding employment.

Therefore, every utility should be interested in calling the attention of the business leaders of its community to the ways in which some industries are alleviating the unemployment situation. These methods will be discussed over the radio under the auspices of the President's Emergency Committee on Employment. Furthermore, utilities may find a welcome response if they stimulate the setting up of an employment clearing house in their territory so that there will not be the customary delay in placing men who are out of work.

One-piece insulators coming into favor

SOME interesting facts regarding the comparative value of multipiece and single-piece pin-type insulators were brought out in a recent report made to the Great Lakes N.E.L.A. Engineering Section Committee on power-system insulation at Urbana, Ill. Damage by electric flashover was 0.9 per 1,000 on one-piece insulators and 4.3 per 1,000 on multipiece insulators. Damage by rocks and gunshot was 1.4 per 1,000 on the one-piece type and 8.9 per 1,000 on the multipiece type. The comparative investigation covers the first nine months of the year 1930.

Trial installations of one-piece insulators were made in the vicinity of schoolhouses where much trouble had been experienced with multipiece insulators, and the trouble was virtually eliminated. Out of a total installation of 8,000 one-piece insulators, no insulator failure was reported for the first nine months of 1930, whereas on a total installation of 126,000 multipiece insulators a total of thirty-two failures was reported for the same period of time.

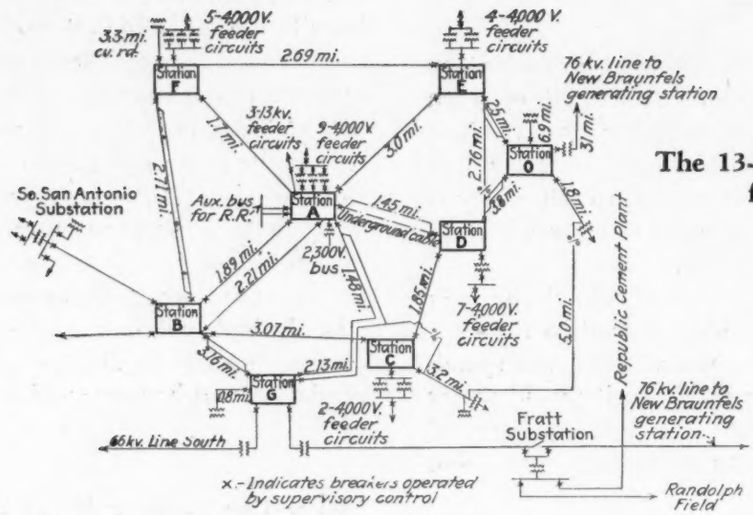
The latter report is not very conclusive, owing principally to the great difference in the quantities. But the lower flashover per 1,000, and particularly the enormous reduction in breakage by rocks or shots, is of great interest. A number of manufacturers are now making one-piece units for reasonably high voltages. If further investigations confirm the results thus far obtained, single-piece insulators will be more widely used.

Why the power level of broadcasting should be raised

RURAL statesmen in the two houses of Congress are not working in the interests of their constituents when they fight against higher powers for radio broadcasting stations. Back on the farms and in the villages the voters who elected these suspicious legislators are operating many radio receiving sets at their extreme peaks of sensitivity in efforts to receive programs from stations hundreds of miles away. During winter evenings at least, thanks to progress in receiver design, they usually get the programs they are after. But they also get the crashes, rattles and buzzes of natural and man-made static, which have been intensified by the more sensitive sets now used.

There are two ways to stop radio interference of any kind. One way is to eliminate it at its source, a job that is enlisting sincere and often expensive efforts. The other way is to ignore the interference by raising the received signal above the level of the interfering noise. The only way that this can be done is by increasing the power of broadcasting stations. Good reception cannot be obtained with receivers so sensitively peaked as to respond to every last electrical disturbance in the ether.

Sales of radio sets are definitely tied in with increased power for broadcasting stations, so the electrical industry has a selfish interest in the granting of the request of many broadcasters now asking for more power. Radio broadcasting is not saturated; it is stifled.



The 13-kv. distribution system for San Antonio

Supervisory for San Antonio

By BRYAN GOUGER

Electrical Engineer, San Antonio Public Service Company, San Antonio, Tex.

DISTRIBUTION lines of the San Antonio Public Service Company extend for miles out from the leading highways of the city, and loads of 500 kw. to 1,000 kw. are continually being added within the city limits. Such growth has necessitated the expansion of the company's system until it now comprises 20 substations.

A system of this size, spread out over some 40 square miles, resulted in an ever-increasing demand for the best and most continuous service possible and made the question of control a vital one. To provide the proper control three proposals were considered: First, the placing of operators at each of the major stations; second, the use of automatic reclosing breakers; third, the use of supervisory control.

The first consideration was rejected owing to the high operating cost which it would involve. The second would have been the most economical and was very well adapted for the 4,000-volt feeder circuits, but its application to the breakers on the loop lines was not practicable, because of the possibility of the system becoming divided between two sources of power and the reclosing breakers bringing them together out of synchronism. The installation of supervisory control was adopted as the most practical solution to the problem owing to its flexibility. This decision and the original installation were made in 1926.

Of the 20 substations, those ten which form the backbone of the electrical distribution system for the city of San Antonio are remotely controlled from a central dispatching office in the distribution office building by supervisory control equipment. The "synchronous-visual" all-relay type of supervisory control is installed. The substations operated by means of supervisory control are shown on the system diagram. There are six substations which are tied together by a loop line surrounding the city, with a seventh station in the center tied to each of the other six by radial lines. This system resembles a wheel with the rim and spokes representing the 13,000-volt lines, with the spoke and rim intersections, and the hub representing substations. Out of these substations the 4,000-volt feeder circuits spread to cover the entire city.

Of the other three substations operated by supervisory control, one is a receiving station from the main generating plant at New Braunfels, which is cut in on the 13,000-volt loop. Another substation is outside of the loop and is fed by a radial line from one of the substations in the loop. It is proposed that this substation shall at some future time be joined to other stations outside the present loop to form a second 13,000-volt loop around the city. The other substation is not a part of the city distribution system and was built to serve an outlying cement plant and the Randolph Air Field, which is now under construction.

Previous to the installation of supervisory control

storms were always a source of trouble in operating the system. Many times the entire operating personnel from the superintendent of distribution down were necessary to straighten out the tangle and speed up the work of restoring service. In cases of severe storms it was necessary to dispatch a man to each of the substations and to place the distribution superintendent at the distribution office to act as dispatcher. The construction men had to be depended upon for assistance in such cases, and often trouble and delays were experienced in getting in touch with them and getting them to the various substations.

Despite the vigorous efforts to overcome these difficulties things did not work as well as might have been expected. There was difficulty in establishing satisfactory communication when a storm broke owing to the telephone company having its own share of trouble from the same storm. Difficulty was also experienced because of the loading of telephone lines as a result of incoming trouble calls from customers, and unlisted numbers were found to be anything but private in cases of dire need.

Operating difficulties of this kind made it easy to obtain approval for a supervisory control installation when its possibilities were understood. The different supervisory control systems were studied and, as stated already, the Westinghouse "synchronous-visual" all-relay system was decided on and purchased. After the purchase of this equipment it became the writer's duty to study the equipment and familiarize himself with it to such an extent that he could install and operate it.

Operation of control system

The supervisory control operates over line wires similar to those used in telephone practice. The line wires were provided by lead-covered No. 10 gage telephone cable strung on a messenger wire on the poles which carry the 13,000-volt and other distribution lines. The only exception to this was in the case of the substation built to serve the cement plant and Randolph Field. As this station is approximately 14 miles out of town it was decided to use open wires instead of cable. The cost of installing the cable was about 26 cents per foot, including

Ten major substations are completely controlled by supervisory equipment. Time delay during troubles is eliminated. Maintenance and costs fully justified by better service.

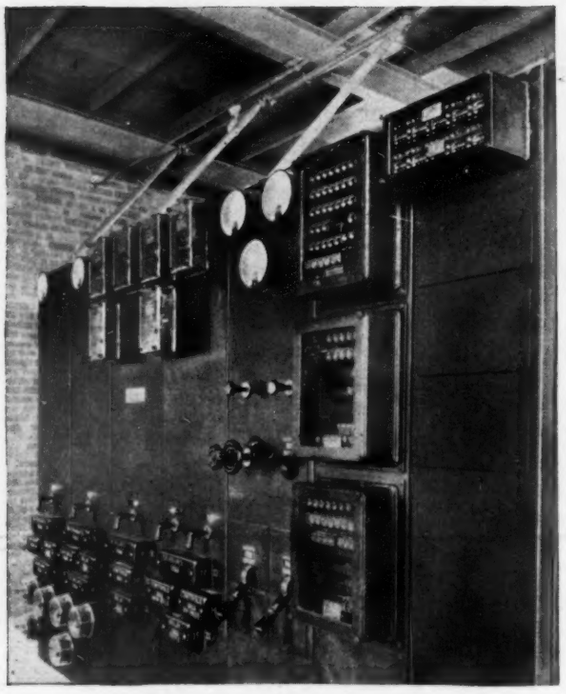
labor costs and such other essential material as messenger wire and cable rings. No cost for poles is included, since existing poles were used. Outside of the equipment furnished by the manufacturer the cable constituted the chief expense.

Upon the completion of the supervisory installation immediate relief from trouble was felt. Of course, the supervisory control did not reduce the amount of trouble, but the ease and speed with which the equipment was handled made it a pleasure to watch it operate. The feeling at that time—to express it in Texas style—was a good deal like that of the rancher who wore tight boots because they made his feet feel so fine when he took them off. In this case, however, one tight fit was enough; once the tight boots were off they were kept off.

The relief experienced by the use of the supervisory system was not due to any reduction in man power, but to the speed and ease with which service was restored. The speed of restoring service not only created good will but meant a saving in dollars and cents.

The centralization of the distribution system control was a feature not entirely appreciated until the completion of the new power plant at New Braunfels. This plant became the chief source of supply, power being received at San Antonio first over one 76-kv. transmission line and then later over two such lines. The power plants in San Antonio were then used for standby purposes or operated at reduced capacity. With this set-up the supervisory control is often used to drop large blocks of load in cases of power-plant or transmission-line

Supervisory control dispatcher's board



Supervisory installation in substation

trouble. By this means the most vital load is carried, whereas without the ability to drop large blocks of load hurriedly a system outage would result.

As previously stated, the system went into perfect operation; however, a certain number of minor difficulties were encountered. After the completion of the installation it was carefully watched and inspected in order to determine what trouble might be expected and the best methods for maintenance. During this time troubles were found to be caused by trees rubbing through the lead sheath on the line cables and grounds on battery circuits at the substations. The trouble caused by trees has gradually been eliminated by trimming of trees and use of tree guards.

The most serious trouble was that due to grounds on battery circuits, since this condition in certain cases resulted in a failure to operate the supervisory system. On the original installation a 48-volt tap on the substation 125-volt battery was used to operate the supervisory control, thereby tying the supervisory control to the direct-current power-control system of the substation. In some cases the control systems were very old and some partial grounds existed. These grounds did not affect the 125-volt control system, but did cause erratic operation of the supervisory system. This trouble was eliminated by the installation of a separate 48-volt storage battery at each substation.

During the life of the equipment there have been a very small number of failures to operate, virtually all of which occurred before the installation of the individual 48-volt batteries. The possibility of a failure to operate has been eliminated in the later installations as the design now used by the manufacturer includes an operation control circuit whereby all operations are performed by coded signals. On the original installation one impulse closed or opened a breaker, while with the operation control on the later equipments a series of five impulses is used to close a breaker and three impulses to trip it. Considering the fact that approximately 200 oil circuit breakers are operated each month the percentage of tie-ups has been very small.

Effect of a bus short

Only once during the history of the supervisory control has it been tied up at a critical time. One evening at about 9 o'clock the power system experienced a severe surge. A number of breakers dropped out, and at the same time the supervisory control for nearly every station went out of service. Consternation reigned, and it took a few minutes for the operators to determine what to do, their dependence on the supervisory control having been complete. It finally developed that a short circuit had occurred on a bus at one of the substations owing to the failure of a lightning arrester.

When the cause of the accident was investigated it was found that the high current in the 13,000-volt line induced a current in the supervisory control cables which blew the 1-amp. cartridge fuses in the line wires at the dispatcher's office and at the substations. The supervisory apparatus and the operators are protected by means of a special protector unit from any high voltage which may get into the line cables. This is a four-electrode protector tube filled with an inert gas at a low pressure. The gas used is easily ionized, thereby providing a large current-carrying path across the gaps to ground. In addition to the protector tubes there are 1-amp. fuses in each line wire. In the case in question the protectors had functioned correctly and cleared the apparatus from the induced surge on the line wires. However, it was decided that it would be preferable to have a few relays burned out occasionally rather than to have the entire supervisory system put out of operation, and the 1-amp. fuses were replaced by others rated at 10 amp. Since this change was made several severe surges have occurred, but no relays were damaged, the fuses did not blow and the protector tubes adequately drained off the induced currents.

Maintenance and cost experience

The satisfactory operation of the supervisory equipment has been due in a great degree to the strict maintenance schedule. This maintenance work takes one man about two days a week. It is very little trouble and often anticipates and prevents trouble. The work of the maintenance man consists of going over all the relay contacts to see that they are clean and to see that all relay armatures work freely. In addition, each breaker is operated once a month to insure its operation both mechanically and electrically.

The cost of the supervisory control system has been justified from several standpoints. More nearly continuous service is obtained, with its resultant public good will and increased revenue. Further, the control of the entire power system is centralized under one man, which eliminates the usual difficulties resulting from lack of co-operation between individual operators.

To assist the central dispatcher in keeping a physical picture of the system a system diagram board was installed in addition to the supervisory control dispatcher's board. On this system board aluminum strips, colored according to voltages, are used to designate the various lines. Miniature disconnecting switches are used to

represent air-break and disconnecting switches. The oil breakers are represented by a pair of red and green indicating lamps which operate in parallel with similar lamps on the supervisory control board installed in the dispatcher's office.

The gratifying feature of the supervisory system is the high degree of reliability and ease of maintenance of the equipment. On the few occasions when trouble occurs with the equipment the reliance placed upon it is realized fully. However, these occasions have become so rare that the supervisory equipment is now classed along with the other equipment, such as transformers and regulators, in the matter of maintenance, reliability and avoidance of worry.

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Stabilizing Employment*

By GERARD SWOPE
President General Electric Company

FOR many years the General Electric Company has been making constant endeavors, each one a step in a comprehensive program, for removing fear of the future from the minds of the worker in the shop; that is, his constant fear of not being able to provide for and take care of his responsibilities, first to his parents, or, if he has taken on further responsibilities, to his wife and children.

The first item to give peace and security of mind is provision for the uncertainty of life. In 1919 free group life insurance was offered by the company, to which later was added a participation by the employees, so that the life insurance of each employee has been increased. This has been received very well by all the employees, and all new employees coming into the organization, after five years of service, come under its provisions. The maximum life insurance offered free by the company is $1,500 and the additional insurance, paid for by the employee, varies, depending upon his age, service and salary, but usually is in the same amount or larger than the free insurance offered by the company.

The second matter of importance in assuring peace of mind, not only of the employee but even more frequently of the wife, is the ownership of the home. While the General Electric Company has never been in the position of landlord, it does assist the employees in acquiring or building homes. In the last seven years 2,500 homes, worth $19,000,000, have been acquired or built by the employees, with a payment on their part of upward of $6,000,000, the balance being held in the form of first and second mortgages by regular financial institutions, the company making provisions so the employees can borrow this money on a favorable basis. To date there has been no loss in connection with this work, either to the banks or the company.

The third is a plan to enable the worker to put something aside for the inevitable "rainy day." The General Electric Company, like many companies, started with the plan of having the employees subscribe to its common stock. But its common stock, of course, is subject to the fluctuations of all stocks. A new company was organized, known as the General Electric Employees' Securities Corporation, where the General Electric Company takes the stock risk and the employees subscribe for its bonds. These bonds are not subject to the fluctuations of the market, but are redeemable at cost at any time the employee so desires. Investments have been so diversified that the market value even today exceeds the cost, and the income return has always been ample to pay the return on the bonds and stock that have been issued. Upward of 36,000 employees now hold bonds, with a total value of $41,000,000.

The fourth item to give security and peace of mind is provision for old age. Of course, if each employee made provision along the line of the above, for death, a home and savings, old age provision, theoretically, might not be necessary, but experience has proved that it is. The General Electric Company in 1912 adopted a pension plan which gave a pension to every employee, and this has since been supplemented by what we call an additional pension plan, whereby the employee contributes 1½ per cent of his earnings. Since the inauguration of the plan, the pensions paid to retiring employees have amounted to almost $4,000,000 and there are approximately 1,000 on the pension rolls of the company at the present time.

The fifth, and probably the most important from the standpoint of the worker, is the recurrent dread and fear of unemployment. For years the General Electric Company has been developing methods of stabilizing employment for its workers. This varies, of course, with the product. It is easiest in a standardized line, which does not become obsolescent and does not deteriorate.

**From address in connection with President Hoover's Emergency Committee for Employment.*

One such article is the incandescent lamp, where for many years we have been able to avoid unemployment because of seasonal fluctuations by making lamps in the summer time, when fewer lamps are used, storing them and distributing them to our customers in the fall and winter months when the days are shorter.

Fundamental in this new plan for relief are the following principles:

1. Joint and equal contributions by employees and the company.
2. Joint participation in the administration of the plan.
3. Aid through group action to those workers who are in need or require temporary loans, or who become unemployed, or for whom only part-time work is available.
4. In times of unemployment emergency, co-operation and assistance from those employees of the company not usually affected by unemployment, and assistance by the company in equal amount.

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Natural Gas and Oil as Utility Fuel

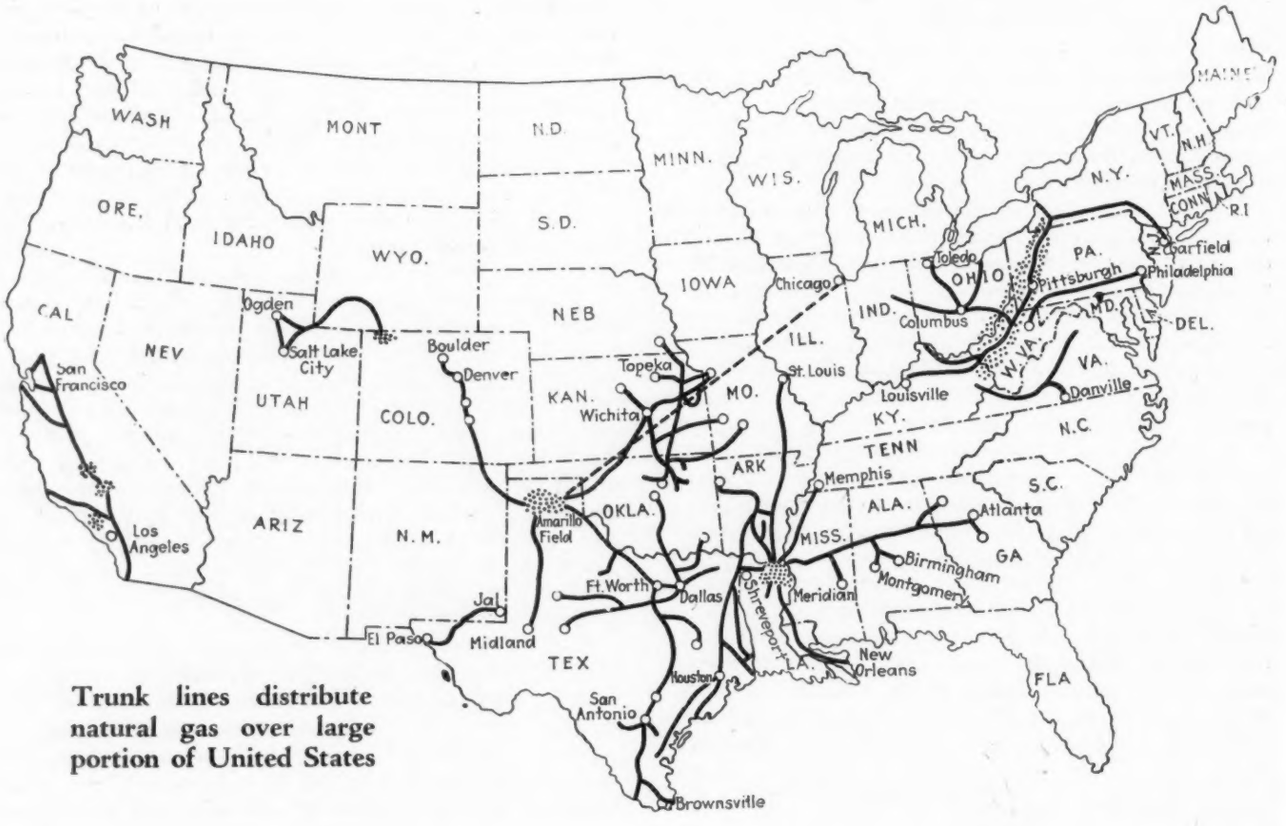
NATURAL gas and oil are now available as fuels in the industrial and public utility fields over a large portion of the United States, according to a report of the prime movers committee of the N.E.L.A. Large-scale use of both these fuels has been stimulated by increased production from new oil fields in California, Oklahoma and Texas and by a great improvement in distribution facilities.

With gas fuel no treatment other than accurate pressure control is required beyond the use of a burner equipment which insures rapid and thorough mixture of the gas with the air. However, since the gas-burner pressures are low it is very important that the gas regulators maintain pressures constant within a few ounces and that drops between burners and regulators be low.

The atomizing features of most oil burners require that the oil be fed to the burners under pressures between 150 lb. and 200 lb. per square inch, and also that the oil be heated sufficiently to reduce its viscosity to between 180 and 200 Saybolt sec. The required temperature is usually between 160 deg. and 250 deg. F.

At least two methods have been introduced to increase the capacity range of mechanical burners, which formerly was limited to about 50 per cent of maximum output. The more widely used of these is that of returning a portion of the oil from the central part of the burner tips after the tangential slots have given the whole mass the required whirling motion. This method allows a reduction in capacity to 15 or 20 per cent of the maximum without changing the character of the spray from the burner tip sufficiently to affect the fires, although the angle of the spray widens somewhat as the capacity is decreased and may impinge on the refractory of the burner arch at low ratings. The return of large quantities of hot oil to the supply tanks or pump suction is objectionable as it increases the fire hazard and decreases the fuel-pump capacity. A recent change in this method returns the oil directly to the burner header by means of an additional return oil pump.

A second method used to obtain reduced capacity is to admit the oil to the central tip section through two independent sets of tangential slots with separate feeds from the burner header, either or both being used as desired.



Trunk lines distribute natural gas over large portion of United States

Trials with this method indicate the possibility of successful operation at as low as 35 per cent of maximum capacity, and while this system does not give the capacity range of the return system, there is a decided advantage in returning no hot oil. Without the return system, the amount of oil discharged from a burner tip follows the usual pressure volume relation for orifices, the quantity varying as the square root of absolute pressure.

In most mechanical oil burners a diffuser plate is installed back of the burner tip to insure better distribution of air to the oil spray. With combination burners the diffuser plate is pulled back out of the way when burning gas. The diffuser plate introduced additional resistance in the path of the incoming combustion air and may increase appreciably the required speed and horsepower of the forced-draft fans which are installed. The introduction of the mechanical oil burner necessitated a new type of gas burner, and at least two designs have been perfected to operate successfully with this type of register. In one type the gas burner is mounted on a movable gas-supply tube surrounding and concentric with the oil barrel, the gas being discharged outwardly into the air stream through a number of orifices. In the other type a circular gas box of the general shape of the inner section of the air register is mounted on its inner face, the gas discharging inwardly into the air stream. Both designs give good results operating with maximum gas pressures of from 4 lb. to 6 lb. per square inch. The latter type has the advantage of rigid mounting without flexible connections.

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Deepwater Experience Amplified

By K. M. IRWIN
United Gas Improvement Company, Philadelphia, Pa.

In the December 6, 1930, issue of "Electrical World," page 1044, there appeared a report upon the performance of Deepwater and Gilbert 1,200-lb. stations. This was based upon A.S.M.E. annual convention papers by Messrs. Irwin and Gilbert. To bring the operating and performance story up to date the material here presented was offered as discussion of his own paper by Mr. Irwin at that meeting.

ALL OF the high-pressure steam leaks which have occurred in the Deepwater station have been on the small lines, with the exception of one or two leaks which have developed on the boiler feed lines where they connect to equipment and the joints are not welded. The following gasket practice has been followed:

Boiler manholes—corrugated monel metal.
Reheater manholes—folded asbestos.
Boiler, water wall and superheater handholes—steel-covered asbestos gasket. On this particular type of gasket to date only one failure has occurred, and that was on a handhole plate on one superheater. The gaskets on the water columns are corrugated monel metal. Copper, soft steel and sheet packing have been tried, but with little success, and the monel metal is at present giving good service.
Economizer return bends and flange connection on economizer supply pipes to the boiler drum—a stainless steel gasket is being used in place of the original copper gaskets, and seems to be some improvement.

The stainless steel gasket has one fault, in that if a leak does occur the fitting faces show more signs of being cut than they do when a copper gasket is used. This is probably due to the fact that the stainless steel resists wear more than the fitting faces.

As previously reported, the operating experience with the economizers may generally be stated to be satisfactory, although during the months of September, October and November on six occasions it has been necessary to shut down one of the boilers in order to replace gaskets on the economizer U-bend. This is the same boiler on which difficulty was cited in the original report. Only three leaks have developed on the other five boilers during the same months.

No further difficulty has been experienced with the slag-type furnace bottoms. No. 6 boiler, in which the magnesite bottom was installed the end of August, has been operating satisfactorily without undue expansion and without developing leaks. No. 4 boiler, which originally had a floor made up of cans of coke, but which have now entirely disappeared, has shown no change and is operating with the floor made up of slag. This floor caused the operators some concern for a week or two as the steel plates on the bottom of the floor became heated to a dull red glow, but by raising the slag depth in the furnace the bottom was chilled and has been giving satisfactory service ever since. The measurements of the growth of this floor show that it has the least expansion. It is the intention not to make any changes in this floor unless some unforeseen difficulties arise.

The statement that iron sulphite was responsible for the using up of the coke in the bottoms of boilers 4 and 6 should be changed. This conclusion was reached due to the fact that the manufacturer advised that this trouble had occurred at other plants where no coke bottoms were installed. However, an analysis of the material cut out of the floor of No. 6 boiler shows that the material is similar to the slag which is tapped off in the normal course of operation.

One distinct advantage of bin system

The last three months have borne out the earlier conclusion that there is a distinct advantage in reliability to be obtained from a bin system of fuel firing over the unit system. During the past three months, on seven occasions, it has been necessary to reduce the load on the plant from 5,000 to 12,000 kw. due to difficulty with the mills used on the direct system. This has at times been

due to breakage of mill parts due to wear and may be overcome after the operators are better able to judge a proper maintenance and overhaul schedule. Even with prearranged periodic maintenance it is, of course, necessary to reduce the output unless it is possible to synchronize mill and boiler outage.

In the last few weeks a Pittsburgh seam coal, which it was possible to purchase at a relatively low price, has been burned in small quantities for test purposes, and it was found that using this much harder coal on the direct-fired mills takes considerably more power and reduces output and necessitates overloading the mill motors in order to keep the boilers up to capacity. It is a condition which could not persist over a long period of time, as there is danger of burning the motors from continuous overload, and it is difficult to keep the boilers up to rating. Using the same coal on the bin system, the mill capacity is also seriously decreased, but by operating the mills longer hours it is possible to maintain the boilers at any desired rating. This feature of flexible boiler capacity with varying qualities of coal should be taken into consideration when deciding the relative merits of the two systems.

Other difficulties with the mills have been due to operating conditions, such as plugging of the feeding system to the mill or the plugging of coal in the mills themselves. There have been outages of the mills on the bin system, but it has never been necessary to reduce plant load on the bin system boilers on account of lack of mill capacity.

Refractory erosion most serious problem

Difficulty with erosion of the refractory material which backs up the bare tube water walls on the back wall of the furnaces opposite the burners has increased and is now the most serious trouble being encountered in the boiler room. The operators are experimenting on the bin system end of the plant by varying the secondary and primary air pressures in the hopes of shortening the flames to the extent where they do not throw the slag from the coal against the rear walls and wash them down, and still keeping the flame travel sufficiently long to prevent the flames from carrying this slag up into the lower row of boiler tubes and slagging these over. It is felt that with careful adjustment it may be possible to find the point where a balance between these two extremes will leave a satisfactory condition.

On the direct-fired end the manufacturers are experimenting with deflector blocks to be put into the burners, in order to get better control of the flame travel. On a rear wall now being rebuilt a 70 per cent alumina brick is being used in place of straight refractory, in the hope that this will reduce the washing action of the slag. If none of the present experiments are successful, it may be necessary to resort to an all-metal wall, by using either fin tubes or blocks on the present bare tubes.

Silica deposit on turbine blades reduced

There is a misstatement in the original report in that it was assumed that other plants were having similar difficulty with silica deposit on the blading. We were led astray by an article in *Power Plant Engineering* (February 15, 1928), written by John Anderson, in which he stated that the analysis of the deposit found on the high-pressure turbine blading on the 1,200-lb. machine at Lakeside, Milwaukee, contained 56 per cent silica, and that by injecting 10,000 lb. of water per hour into 15,000 lb. of steam per hour entering the turbine throttle when the machine was rolling at 400 r.p.m., they were able to wash off this scale so that the machine could be restored to its full load capacity.

Deepwater Economy Increased to 12,244 B.t.u. per Kilowatt-Hour

It should be borne in mind in evaluating the advantages of 1,200 lb. against these particular results that a load was carried for 24 hours of the day during the past 3¼ months, which necessitated operating all turbines and five of the six boilers at their maximum capacities, which is a point beyond the maximum efficiency point on the turbines.

	Net Output 1,000 Kw.-Hr.	B.t.u. per Kw.-Hr.		Net Output 1,000 Kw.-Hr.	B.t.u. per Kw.-Hr.
April	19,975	16,752	August	63,775	13,341
May	35,373	14,036	September	63,842	12,749
June	44,707	13,828	October	66,989	12,419
July	43,169	14,114	November 1-15	35,520	12,244

The scale on the blading at Deepwater plant has been analyzed on several occasions and varies between 75 and 95 per cent silica. An attempt to wash this off apparently had no effect, as it did not increase the machine capacity. However, when the machine was taken down for inspection no scale was found on the blading, but the last stage diaphragm had a thin coating which was sufficient to increase the pressure drop across this diaphragm to the extent of reducing the turbine capacity.

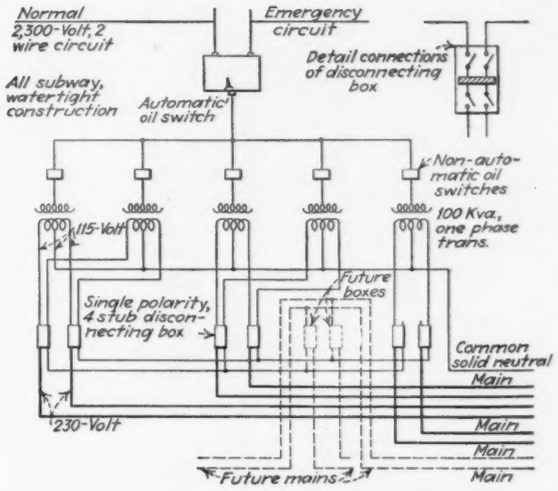
Since the installation of purifiers on the vapor outlets of the house evaporators the quantity of silica in the water is so small that it has been practically impossible to separate it, or even to find it on laboratory analysis. It is believed, however, that some of this must be carried into the pure water system from leaks in the large size evaporators installed for the Du Pont system. The tubes in these evaporators are being rerolled. During the period when evaporators are cracked the pressure conditions which exist in the shell would tend to force raw water into the condensed water side of the system. A 1-in. steam line has also been installed on this turbine to take steam from the first stage into the fourteenth stage, in an attempt to increase the temperature in the last stage of this machine nearer to the temperature existing in the last stages of the high-pressure elements of the compound machine. It would appear that the higher exhaust temperature on these machines must prevent the scale deposit.

One of the low-pressure turbines has developed vibration early in operation when the steam was carried at the contractual temperature. Until such time as it is possible to take this machine down it is necessary to operate it with steam at 700 deg. in place of 750 deg., which, of course, reduces the efficiency of this one unit. It is expected that when the machine is overhauled and a more economic loading imposed on the plant, station economy will be improved by 400 to 500 B.t.u. per kilowatt-hour. This condition of maintaining five boilers at their maximum loading continuously has also brought to the fore more forcibly than in other locations the necessity for continuous availability of the fuel-burning equipment and showed reduction of load due to short-time outages of the direct-fired mills. Normally, this condition of course would not be introduced, as other boilers in the plant would be able to take the small deficiencies.

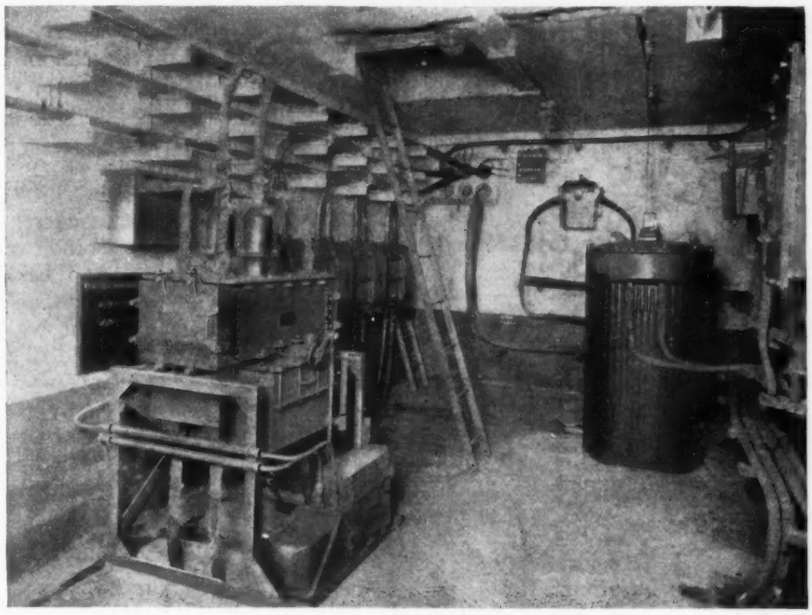
Reliability Dictates Design of Network Vault

INSISTENCE upon service of the highest reliability is adding to the equipment of the modern distribution vault until it approximates in some cases the layout of a small substation. In a typical vault designed for network service on the system of the Edison Electric Illuminating Company of Boston in suburban load centers the transformers are designed either for 4,000-volt, three-phase, or for 2,300-volt, single-phase primaries, and for 230-volt, three-wire secondary service. Transformer units are roughly standardized at 100 kva. each, adding as many units in parallel as are needed.

A typical vault unit, in addition to the transformers and their connections, contains an automatic throw-over switch which connects the supply to an emergency line when the normal feeder fails. The equipment includes the necessary operating potential transformers, a motor-operated switch mechanism and a number of hand-operated plug units for isolating the oil breaker during repairs. The switch is provided with an undervoltage relay and a current transformer with a relay set to prevent operation of the switch in case of a short circuit on the vault load. The secondary side of the transformer units is controlled by disconnecting boxes and the primary of each transformer is protected by an oil breaker. Such a vault is ventilated by a motor-driven fan, automatically drained by a sump pump, and has a common ground bus. The vent openings are provided with automatic shut-offs operated by the melting of fusible links in a chain carried over the transformers.

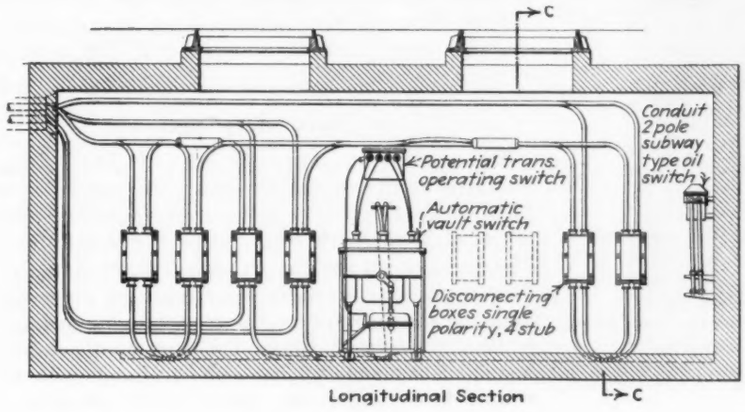


Simplicity a feature of Boston network vaults

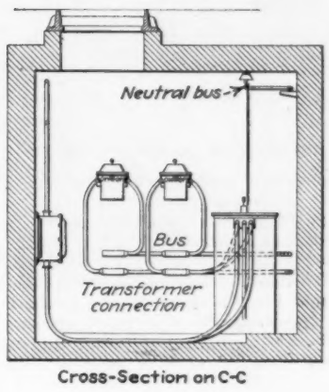


Network vault is compact but uncrowded

Typical vault construction shows space economies



Longitudinal Section



Cross-Section on C-C

Vertical A.C. Networks for Tall Buildings

Features of network distribution system

Lower cost and greater reliability.
Better voltage regulation.
No large riser shafts utilizing valuable floor area.
No main switchboard.
No mass of feeder conduits to each floor.
No spare conduit risers needed for future expansion.
Additional loads may be tapped to the buses at the floor where they are required.
No elaborate anchoring of feeder cables.
No block required at each floor to make tap for 300-400-amp. load.

INCREASING heights of office buildings and greater concentration of load have imposed requirements upon the conventional tree system of distribution which could not economically be met. It was only a short step to adapt the now generally accepted alternating-current underground network to the requirements of tall buildings. The only essential difference is that one is horizontal and the other is vertical. Already several buildings make use of the vertical alternating-current network, the latest of these being the new 28-story Shell Oil Company building in San Francisco with a lighting load of 1,697 kw. and a power load of 760 hp. In addition to this departure there is another important feature. The flat-copper bus has given way to the tubular-copper bus, with a resulting saving in usable floor area and lower cost.

Vertical network

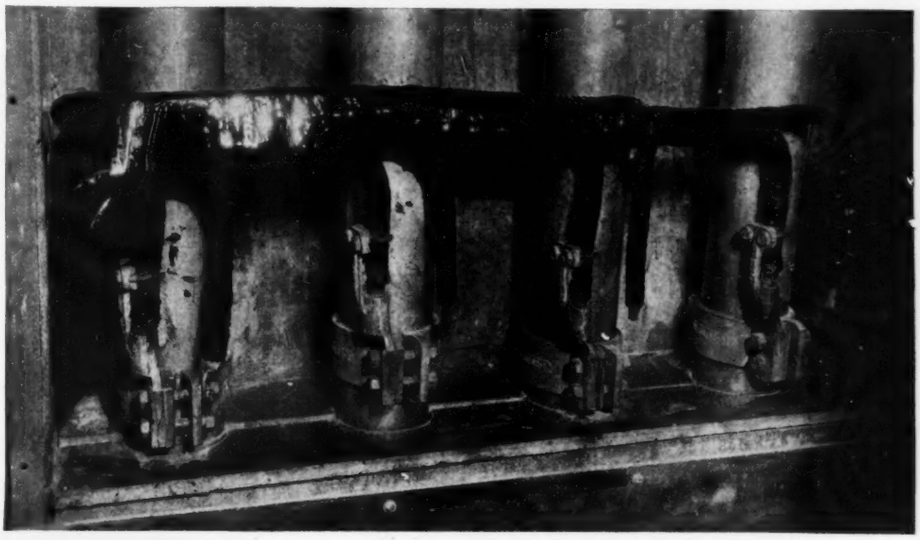
Essential features of the vertical alternating-current network are shown in the accompanying illustration of the building. From this it will be seen that a bank of transformers on the top floor is connected to a bank in the basement through a vertical secondary bus with network protectors at each bank, as well as ahead of a tap from the bus to the underground network mains in the street. Separate 4,000-volt feeders supply the two banks. The network in the building as well as that in the adjacent street area is the now quite generally accepted four-wire, three-phase, 120/208-volt system for both light and power.

The primary cable feeding the roof transformer bank consists of a specially built four-conductor, No. 00 armored cable with a vertical run of 380 ft. It is supported at the top only, by a special armored-wire clamp designed for the purpose. The cable is insulated for 15,000 volts, to be suitable when the system is later changed over to 11,000 volts or 13,200 volts; has an over-all diameter of 3.03 in. and weighs 10.9 lb. per foot.

Secondary network

The secondary bus consists of four 3-in. extra-heavy, iron-pipe-size, hard-drawn copper tubes weighing 11.82 lb. per foot. The conductors were furnished in 20-ft. sections with 8-in. screw couplings for joining. The buses from the twenty-eighth floor to the fourteenth floor were hung from the floor beam on the twenty-ninth floor, as shown in one of the accompanying illustrations, while the sections below the fourteenth floor rest on insulated supports in the sub-basement. At the fourteenth floor expansion joints were provided to take

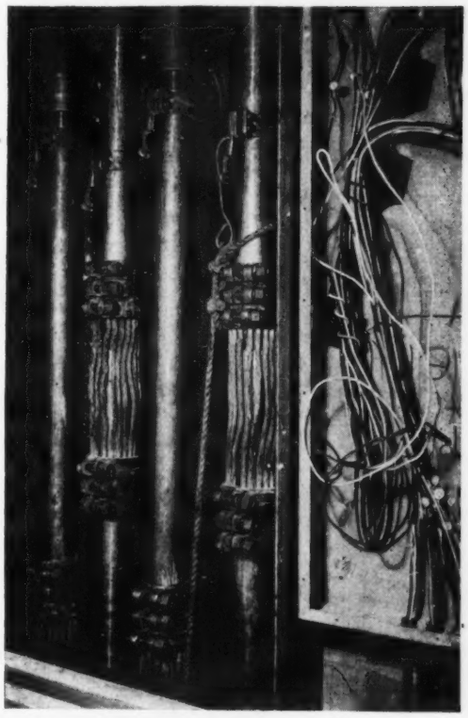
Method of tapping bus to feed distribution panels on each floor



care of expansion and contraction. These are shown in one of the accompanying illustrations. The method of taking off taps to distribution cabinets on each floor is shown in another view.

The entire secondary bus riser is inclosed in a ¼-in. ebony asbestos housing with spacer plates of the same material placed on 6-ft. centers to prevent sideplay of the bus. The tubular bus is placed on 8-in. centers and is uninsulated except at the expansion joints, where micarta tubes were slipped over the staggered joints.

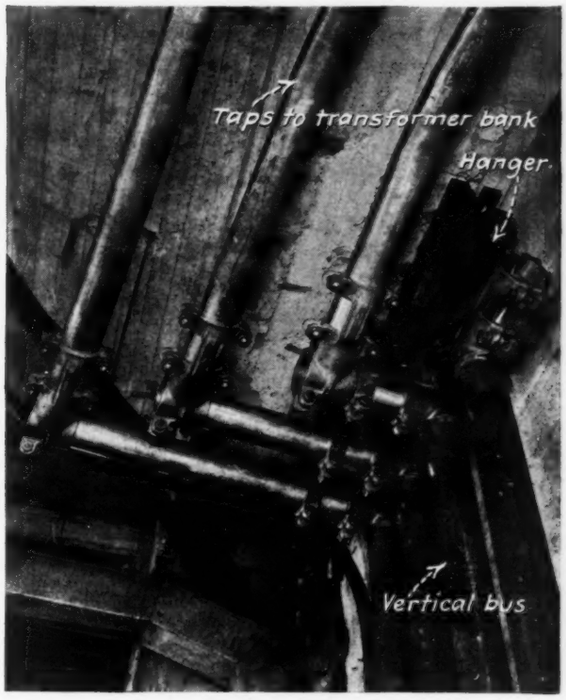
Panelboards are placed in the bus riser shaft adjacent to the bus housing for distribution of light and power to each floor. At some points on various floors where heavy loads were supplied sub-distribution centers were established and sub-feeders carried back to each of the main panels. The network system of distribution made it unnecessary to provide a main switchboard, since oil circuit breakers, network protectors and oil-fuse cut-outs in effect take the place of the main board.



Expansion joints on fourteenth floor between the two vertical bus runs

On the secondary side of the transformer bank on the twenty-ninth floor there is a 2,000-amp. network protector. In the basement vault there is a 1,600-amp. protector, and to prevent back-feed from the building to the street mains a 2,000-amp. network protector was installed in the sub-basement. To permit killing the primary feeder to the twenty-ninth floor an oil switch was installed in the sub-basement. Oil-fuse cut-outs protect both transformer banks.

Advantages of the network system and use of tubular bus were so apparent and economies so obvious that no estimate of the cost of the older type of building distribution was made to get comparative costs.



Hanger on twenty-eighth floor supporting four 190-ft. lengths of tubular bus

Economy of Ground Area in City Substation

Real estate values expressed in figures most frequently used for stating astronomical distances characterize Chicago's Loop district.

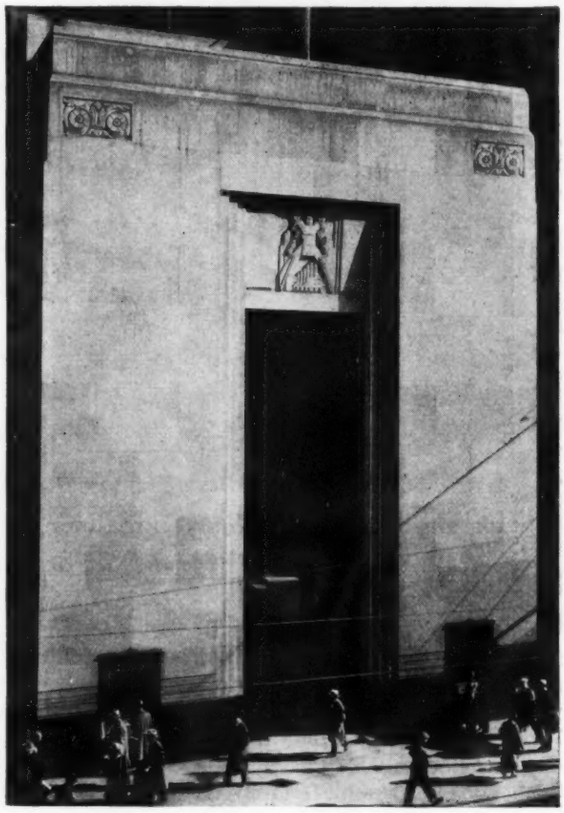
Engineers who build a substation in that area are forced to put every square inch of ground in the lot to the best possible use.

Here is the way the job was done in the latest Loop substation of the Commonwealth Edison Company.

THE approach to the problem of supplying additional substation capacity in the Loop district of Chicago which is indicated by the illustrations on these pages show how the engineers of the Commonwealth Edison Company have taken into account the larger consideration of economy that includes future growth. This consideration imposed upon them the solution of many problems of immediate detail so that the future aim might be achieved. It was necessary to design a structure and a disposition of equipment for present uses in such a way as to permit large later additions. Although the drawings show definite equipments and arrangements for the future construction, it must be understood that these plans are not necessarily fixed. They were made only to serve that human requirement which, for comprehension, demands the visualization of what is to come in terms of what is now here. The working out of the complete plan of the North Dearborn Street substation may, due to inventions and developments, be greatly different from the present picture, but the general plan evolved as the best utilization of the ground area does now exist and in it lies economy.

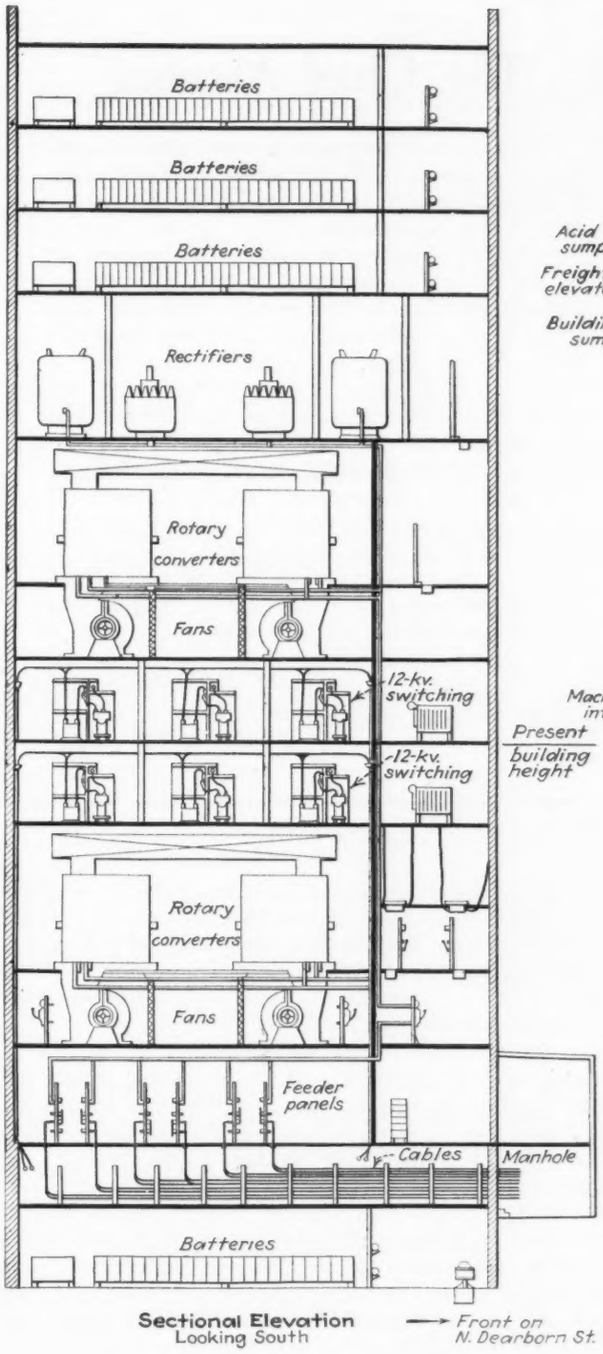
The present idea is that the ultimate capacity of the substation will be 62,050 kw. in fourteen 3,575-kw. rotary converters for light and power service and four 3,000-kw. rectifiers for traction supply. The first section, which is shown in the accompanying illustrations and is indicated by the left-hand halves of the floor plans up to the fourth floor, and which, it should be noted in passing, is architecturally complete and yet includes the design elements for a larger building, contains three of the rotary converters. The next step will be the duplication of the present building on its south side, thus supplying the base for the seven top floors that can be added when required.

Certain features of the design of this substation are worthy of comment. Note how the whole front, clear of major equipment, is used for control boards and as a bus shaft for copper runs and conduit. The only other vertical conductor runs of any length are the 12,000-volt supply cables rising on the back wall of the building to the switch rooms on the third and fourth floors. The only unfilled space in the first two construction units is in the basement and first sub-basement, where provision had to be made for the ultimate capacity in feeder panels and outgoing cables, which, finally, will number about four hundred. The seven top floors are now con-



Half completed but architecturally complete

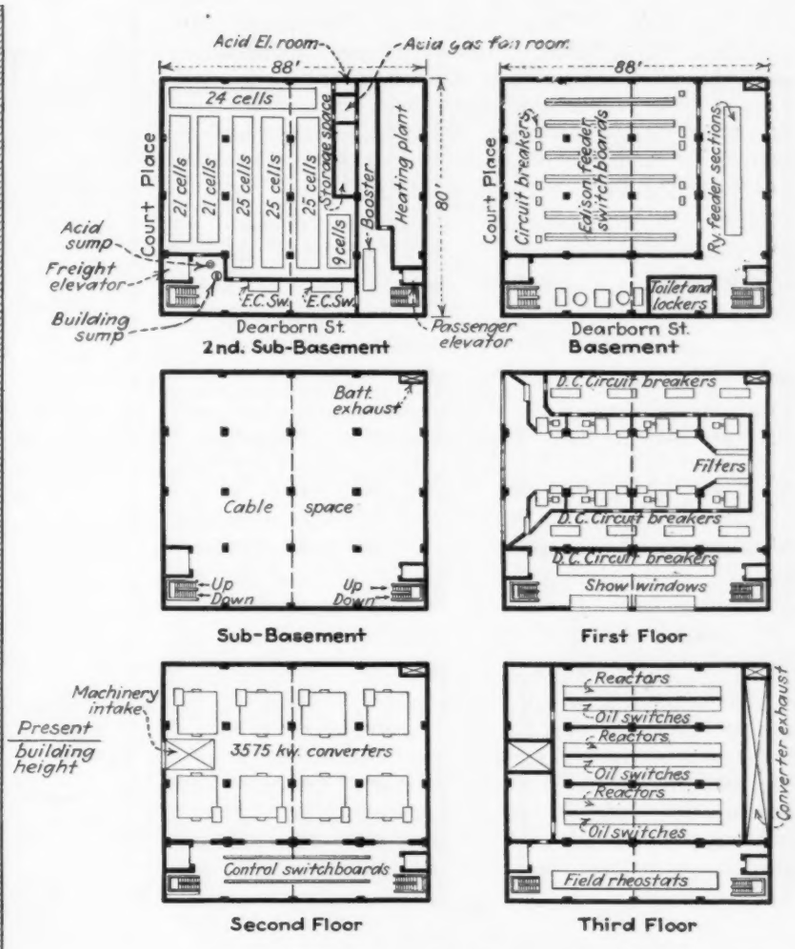
The present building of the North Dearborn Street substation represents only one-quarter of the ultimate project, yet by itself it is architecturally a finished structure. Unlike so many unit projects, there is no appearance here of waiting for something more to be added.



Symmetry makes for compactness

The basic electrical idea of feeding both ways from the center is here expressed in substation design. In the complete project the 12-kv. supply now on the top floor of the present structure will be on the middle floors of the completed building.

templated as practically an inversion of the lower three, high-voltage switching below and batteries above. Not apparent from the drawings is the provision against communication of sound and vibration from the substation to adjacent buildings. This consists of a layer of "Masonite" about 1½ in. thick between the back wall of the substation and the building behind it.



The first stage of construction

These floor plans are included in the present building height, but only in half area. The halves to the right of the heavy dotted lines indicate the next stage of construction. These plans show how the front of the building is virtually a shaft for vertical runs of copper and conduit.

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Variability of "Normal" Eyes Important Lighting Factor

By M. LUCKIESH

Director Lighting Research Laboratory, General Electric Company

Manifestly, it is definite as well as convenient to assume normal vision when appraising the contribution that better lighting makes to seeing. In such cases "normal" vision usually denotes the ability to distinguish a certain line of small letters on the test card of the ophthalmologist. However, there is a wide difference in visual ability among a group of persons that would be rated as normal by this method. This difference in visual ability is significant and might well be considered in the design of scientific lighting for seeing.

The results of an investigation of the visual ability of

nine persons of normal vision are summarized in the following table. A large number of observations were made and the probable errors of the measurements are negligible when compared to the variations between individuals. The results are expressed in terms of the minimum contrast between test object and background required for visibility; these results are then interpreted into corresponding illumination terms:

Analysis of Individual Results	Per Cent Contrast* 100 Ft.-Candles	20 Ft.-Candles
Average	16.4	31.2
Maximum	29.8	51.4
Minimum	9.6	21.1
Average variation from average	5.6(A)	7.2(B)

(Expressed in terms of illumination)

Level of Illumination	Average Variation in Contrast	Equivalent to a Change in Illumination of—
100 Ft.-candles	(A) 5.6 per cent	52.5 Ft.-candles
20 Ft.-candles	(B) 7.2 per cent	8.5 Ft.-candles

*The contrast of a black object on a white background is taken as 100 per cent

For example, the average contrast required, at an illumination of 100 ft.-candles, is 16.4 per cent, while the subjects with the poorest and best vision of this group required contrasts of 29.8 and 9.6 per cent, respectively. The visual variability is most conveniently expressed as the "average variation from the average," which in this case is 16.4 plus or minus 5.6 per cent. A variation of 52.5 ft.-candles is visually equivalent to a change in contrast of 5.6 per cent at this level of illumination.

Since levels of illumination recommended for practice are seldom visually ideal and because of the prevalence of defective vision, it would seem desirable to adjust the lighting to the needs of those with poorer vision rather than to the average of a group with normal vision.

The Chief Menace

The thing that can shake the credit and disturb the progress of our industrial development more than anything else at this time is the menace of government competition.

The main objection to such a policy on the part of the federal government is not that governmental operations are notoriously inefficient; that it would materially increase the tax burden to be borne by all other industries, or even that it might occasion financial loss to the industries faced with such governmental competition, but that it destroys the basic principle upon which the whole of American business has been built.

It strikes at the keynote of our industrial lives (encouragement of individual initiative) and seeks to graft upon the political structure of America the outworn socialistic theories of the Old World which have contributed so greatly to the economic condition of Europe.

P. H. GADSDEN,
Vice-President United Gas Improvement Company,
in Aldred Lecture at the
Massachusetts Institute of Technology

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Portable Kenetron Housing Design

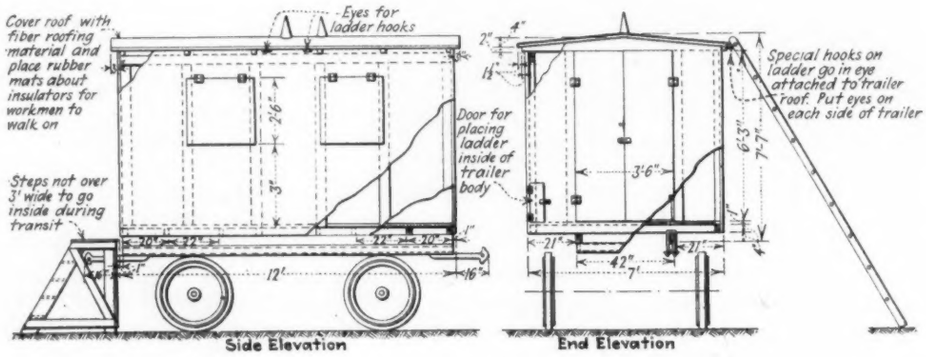
By CARL W. EVANS
San Antonio, Texas

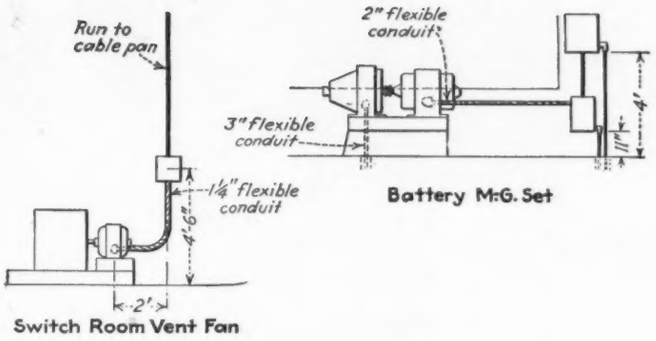
A portable kenetron, housed in a motor truck trailer, is economically justified when large numbers of routine high-voltage tests are made. Yet if adequate consideration is not given to the design of the trailer and to the installation of the kenetron on it, it may be that the advantage of portability will be largely discounted by time lost in puttering around. If the trailer is properly designed, practically all of the operator's time is spent in actual testing and only a minimum required for ground, instrument and apparatus connections. In a large number of tests this factor is very effective in reducing the cost per test.

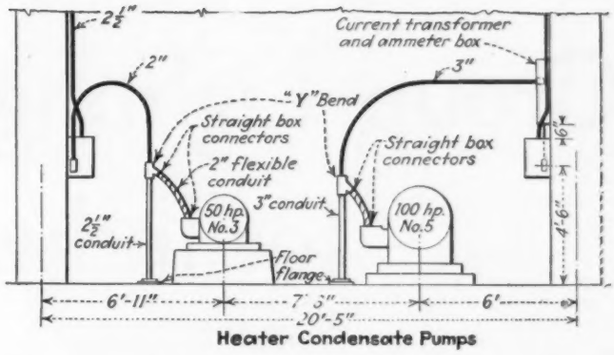
A feature of the trailer here shown is the additional coupling rod at the rear. It is invaluable when the trailer is used in limited areas, as in some substation yards, and the set must be placed in a certain position. Other details contributing to the usefulness of the trailer are the roof bushings to which permanent connections are made from the kenetron set; a special ladder and an inclosed carrying space for it so that the ladder is there when needed; roomy shelves and bins for meters, wires, lugs and spare tungar and kenetron tubes, and, quite important, a convenient receptacle in which supply and grounding connections are made.

Kenetron trailer must be well planned

If it is not, time, which is money, is lost. This design is for a 100-kv. cable testing set and it contains every facility for rapid routine testing. The frame work is 2x4-in. scantling and the roof and sides are of shiplap. The floor is of 1x8-in. boards, and the frame is assembled with bolts and screws, using steel gusset plates and angles at all joints, and is braced diagonally with 2x2-in. angle iron.


Cover roof with fiber roofing material and place rubber mats about insulators for workmen to walk on
Eyes for ladder hooks
Steps not over 3' wide to go inside during transit
Door for placing ladder inside of trailer body
Special hooks on ladder go in eye attached to trailer roof. Put eyes on each side of trailer
Side Elevation
End Elevation





Flexible Connections Facilitate Maintenance

Very little of the control and service wiring of the Powerton station of the Super-Power Company of Illinois is run in concrete imbedded conduit. By far the greater part, in the form of metal-covered cables, is carried about the station in so-called "cable pans." Taking the conduit out of the concrete results in an extreme flexibility of wiring which is carried right up to motor frames. Flexible conduit is used for motor leads. In the case of the battery motor-generator set the flexible conduit runs horizontally without intermediate support for a distance of about 4 ft. The switch room vent fan is connected by a short drop from the control switch. In the connections for the heater condensate pump motors rigid conduit is bent over from the starting boxes and ends in Y-bends fastened to pipes rising from floor flanges. The flexible conduit takes out from the third opening of the Y. The value of these flexible connections is considerable because they permit repair work to be done on motors without disturbing connections. For instance, a motor might be swung out of position for removal of the rotor without disconnection.

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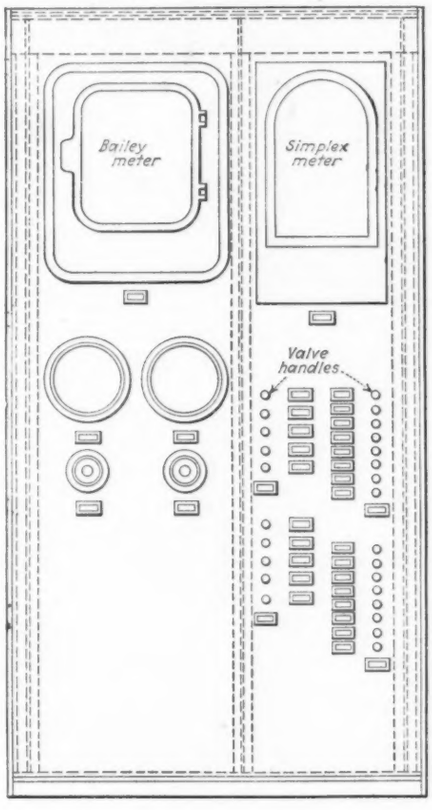
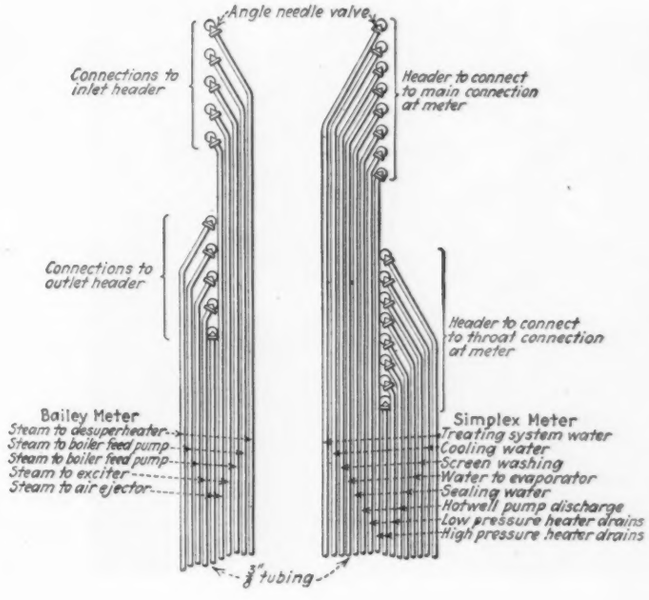
Flow Meters for Multiple Services

Two meters on the boiler room instrument board perform a number of functions at the Belle Isle station of the Oklahoma Gas & Electric Company. These are a Bailey steam flow and a Simplex venturi meter. One can be used for measuring five different steam uses and the other eight water uses. The inlet and outlet tubes from the measuring taps in the steam and water lines are brought to meter headers on the back of the instrument board. A needle valve with the handle on the front of the board is in each tube where it enters its header. Thus a meter can be made to operate on any one of its services by opening the proper valves. Multipliers, based on tube calibrations, are used to correct the meter readings for each service.

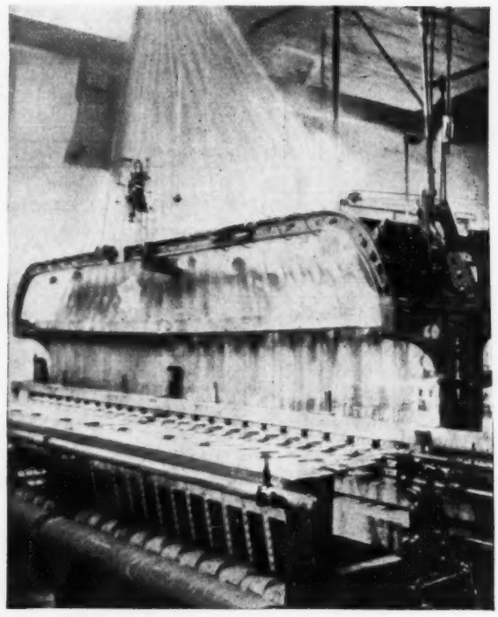




Group Lighting for Industries

By J. M. KETCH

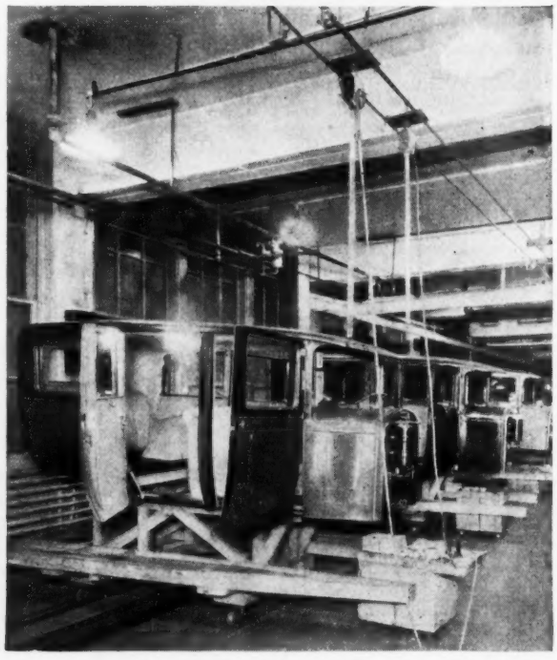
Illuminating Engineer General Electric Company
Nela Park, Cleveland, Ohio



FOR many industrial requirements the lighting system may be designed with little, if any, consideration for the position of machines or workbenches by the duplication of light sources to the point that the total illumination approaches the effect obtained from a natural skylight. However, there are other manufacturing operations for which the lighting must be located with respect to the machine or bench groups if satisfactory work is to be expected. As progress is made in the art of applied illumination, more and more thought is being given to the group, or localized general, lighting plan as a modification of general lighting.

While it is probable that more than one of the following factors influence the selection of a type of lighting system, there are three well-defined elements that one should consider when deciding upon the arrangement of the lighting outlets. These are:

1. Group lighting to supplement a general lighting system. Lighting plus.

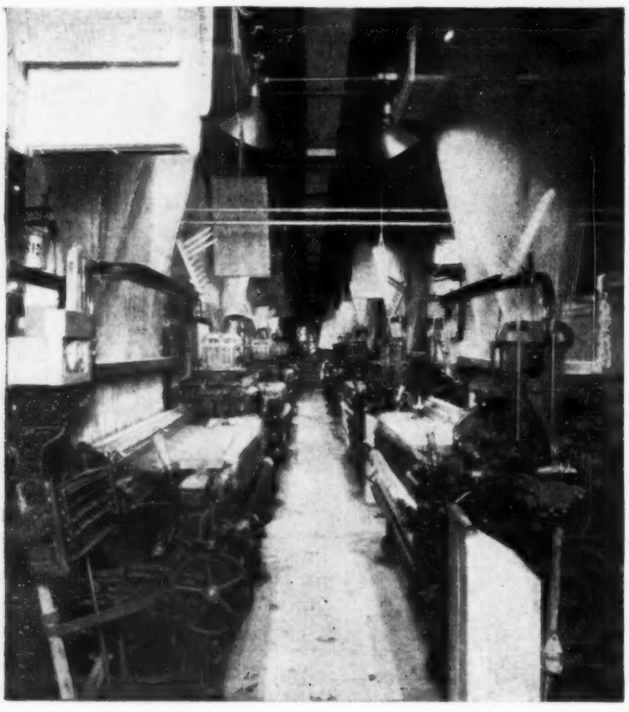


Power for portable lamps and tools is provided by collector sliding on bare trolley near ceiling

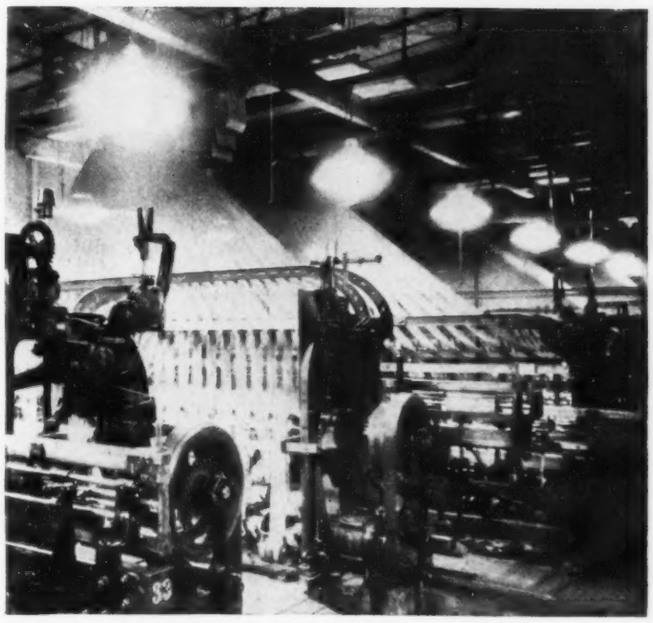
2. Group lighting, an economy measure for obtaining maximum light on the work for a given expenditure of wattage.

3. Group lighting to control the direction of light.

A decade ago we entered the beginning of an era of foot-candle engineering. Whereas much of the previous

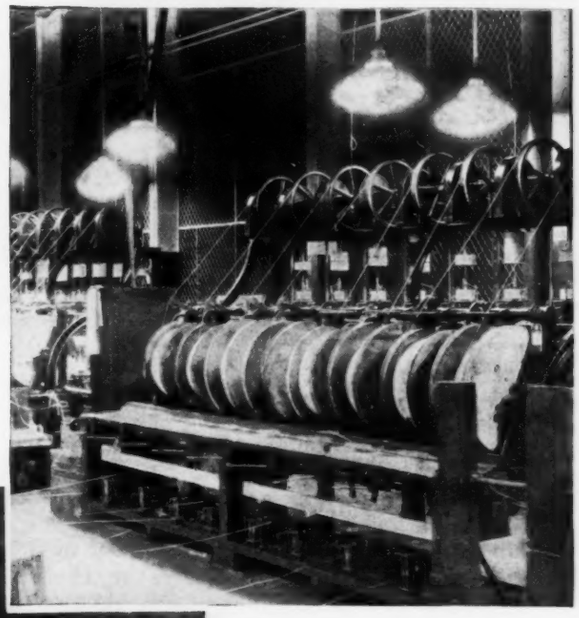


Each row of Jacquard looms is considered a special illumination problem. Besides the angle reflectors in front of each loom there are units above the runway to illuminate the work heads and still others located back of the looms to facilitate tying in new rolls of warp



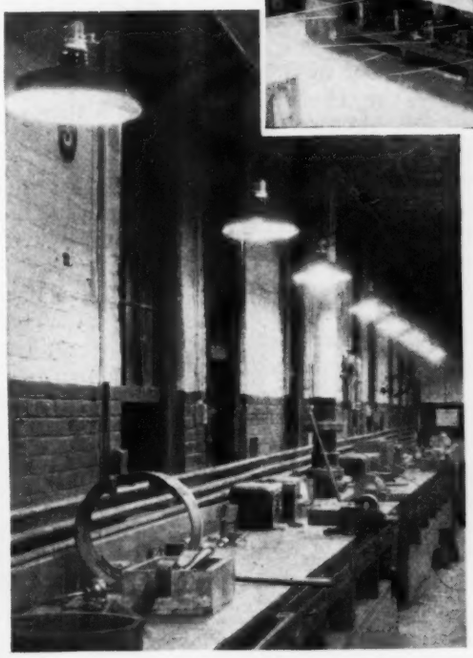
Two 300-watt "glassteel" units in each work aisle and two in each back aisle avoid shadows on these looms weaving fine patterns of silk on suit labels. Units are 9 ft. above floor, spaced on 6x8-ft. centers, giving 35 to 40 foot-candles

Twenty foot-candles illumination is obtained on the work side and 10 foot-candles on the back of these machines braiding fine magnet wire by 200-watt units mounted 9 ft. above floor in two rows

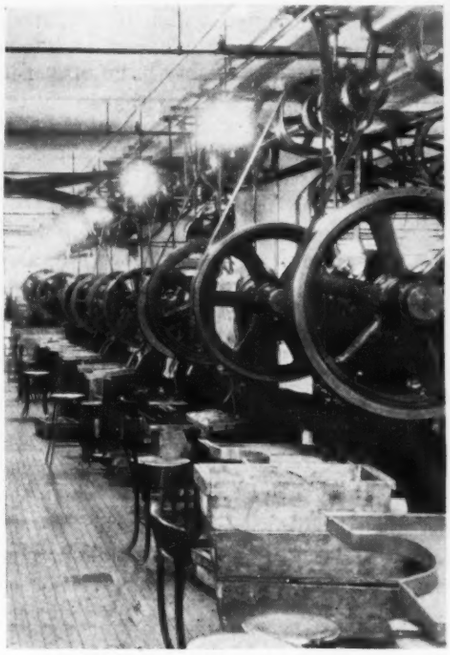


lighting had been meager, glaring and wholly inadequate, the development of equipments and lamp finishes made high levels of illumination safe and reasonably free from glare. With the possibilities of higher levels and the development of the foot-candle meter we at once became foot-candle conscious.

General lighting came into prominence, and to many seemed to be the last word and answer. However, numerous tests on the science of seeing taught us that for best vision, levels of illumination were required that were far in excess of the ten, fifteen and twenty common to general lighting systems. Furthermore, this research has pointed the way to economic standards of lighting not safely practicable with the equipments commonly recommended. These conditions very quickly nurtured ideas of supplemental lighting, lighting plus, industrial floodlighting, intensifiers, and others. All have the same purpose in mind, but differing only in the method of accomplishing it.



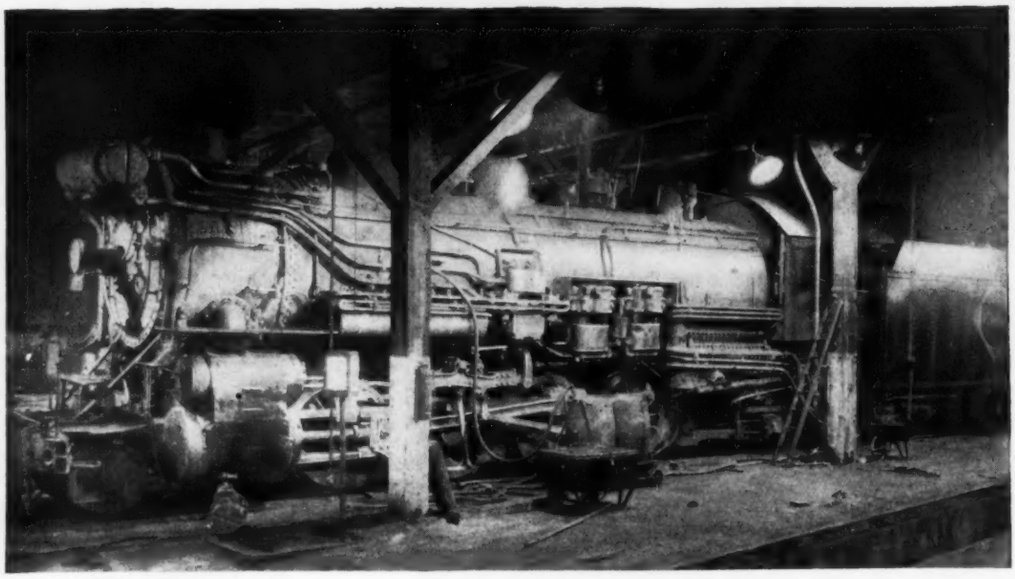
Row of lighting units near wall gives good illumination for bench work



Accidents are prevented in this pressroom by locating lighting units so shadows on die blocks are eliminated

Local lighting has been used by many for this purpose, but the new ideas embraced a new conception of local lighting—well-designed glare-protecting reflectors, with rugged mounting on adjustable arms or on floor stands—lighting by which it is possible to build the levels up to 100 or more foot-candles over small areas.

In other places the provision for needed high intensities has been obtained by the use of general lighting, plus industrial floodlights and intensifiers mounted on the ceiling out of the way, and directed at the area for which high levels are desired; others again merely



An extra helper to carry an oil torch would be necessary in this roundhouse if it were not for the properly located lighting line

double or treble the general lighting equipment over the desired area.

It is believed that we are at the end of one era and at the beginning of a new one in which lighting plus will be more used than straight general lighting, vision specialists will replace lighting specialists, and the science of seeing will be of more importance than the mere calculation of foot-candles. Tailored lighting will replace rubber stamp lighting specifications.

Several industries manufacturing bulky products require considerable temporary storage space between groups of machines. Typical of these are the woodworking industries. It is evidently poor economy to spread excessive wattage over the entire area to obtain the necessary foot-candleage at the machines. Grouping the lighting units about the machines and using smaller wattages or wider spacings over the storage area is the obvious modern lighting solution for such locations.

The same spacing throughout, but with a differential in the wattages, has the advantage of providing for future expansion of production work into storage areas.

There are today a large number of industries that might be classed as standardized. The machines of a given class are uniform in size and grouped uniformly to give the best working space for the employees and speed the handling of materials. Notable among the standardized industries and processes are: Automobile body manufacturing, serving rooms, machine glass casting, leather manufacturing, shoe factories, meat packing, paint grinding, paper manufacturing, presses, printing, rubber manufacturing, textile mills, woodworking plants.

In all of these industries are departments and processes where the direction from which the light comes, or its position with respect to the machines, is quite as important as the illumination level. Many of the surfaces worked upon are vertical, many are under a huge machine head or shadowed by complicated machine parts, but all can be lighted satisfactorily by some form of group lighting.

The direction of light, the elimination of disconcerting shadows and the foot-candleage are all important in the industries listed and the designs must be made with those elements in mind. In many of them systems can be designed that comply with the principles of general lighting as regards spacing and mounting height, and have the additional advantage of providing at least a good general lighting system if the present department is replaced by another with different requirements.

New Control-Cable Standard Based on Practical Needs

By G. SUTHERLAND*

Chairman N.E.L.A. Electrical Apparatus Committee

THE standard color scheme for control cable, recently adopted by the N.E.L.A. electrical apparatus committee and the N.E.M.A. power cable group, is based on the best modern practice and experience found in these two national associations since it was formulated by a joint committee of the two organizations.

Having been prepared by operating engineers to overcome many of the past objections to colored control cable, it is not feared that much trouble will arise in fitting this color scheme into existing systems, since it retains the essential features now used by twenty large operating companies. Neither is it expected that old installations need be changed over to this color scheme, but it is hoped that future new construction will follow the new standard.

Economies of purchase will accrue to the industry when all manufacturers are able to standardize on a uniform national colored control cable specification. Such a standardization will permit stocking control cable, thereby allowing its manufacture during off-peak periods, resulting in better deliveries and less construction delay.

A survey of 26 leading utilities disclosed such a large degree of uniformity of colors up to twenty conductors that it was merely a case of holding field tests to determine which colors could be most easily picked out when badly soiled and under poor lighting conditions. It was not a case of working with unknown material, because a large number of leading operating companies have been utilizing colored control cable for many years. So few companies reported the use of a spotted and stripped color scheme that it was not considered necessary to study this method in further detail. It was a case of

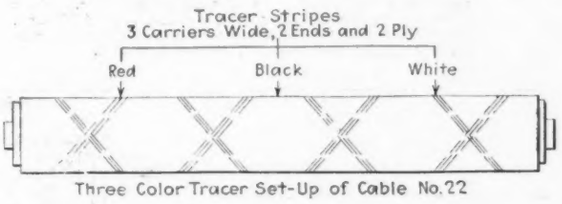
*New York & Queens Electric Light & Power Company.

co-ordinating the best practice and preparing a specification to secure the proper color and tracer stripe arrangements. The colors finally chosen appear in the accompanying table. While the order of color cabling has been changed somewhat, the majority of colors used by the twenty above mentioned companies are still listed in the table.

The basic colors are arranged in the order of their cabling, the more commonly used being assigned the lower numbers. The cables in a six-conductor braided cable, for example, will thus utilize the first six basic colors, black, white, red, green, orange and blue. For a 21-conductor cable the first 21 color combinations will be used. It will also be noted that the tracer development follows the same orderly layout as the basic colors.

The field tests consisted of deliberately soiling two comparative sets (A and B) of differently colored samples with dirt, grease and oil to approximate conditions usually found around switchboards. Set A consisted of a scheme using a 50 per cent distribution of colors for two color combinations and a 33⅓ per cent distribution for three color combinations. Set B consisted of the regular basic colors with one or two tracer stripes. Each set was jumbled up in a heap. Maintenance men and installers were asked to pick out and arrange the cables in the order shown in the table, each complete operation being timed for each individual. The lighting was also varied from good daylight to average artificial lighting, such as found between switchboards and in vaults or manholes.

It was found that such hues and color combinations as brown, violet, yellow and white, green and blue, blue and black, green and black, green and lavender fail very badly to show up their identity under poor artificial lighting. The men would invariably stumble over these colors and take a longer time than when picking out the more pronounced hues. Tests on orange and yellow colors proved that the orange was the most distinctive. The most troublesome color combination for the men to determine was one using green with a blue tracer. Each man insisted that he found only one color, until coming to the end of his table the omission was discovered.



Three Color Tracer Set-Up of Cable No. 22

Standard Color Scheme for Control Cable

Sponsored by the Joint N.E.L.A.*—N.E.M.A.† Committee

Base	Tracer	Tracer	Base	Tracer	Tracer
1. Black	.....	.....	20. Red	Green	.....
2. White	.....	.....	21. Orange	Green	.....
3. Red	.....				
4. Green	.....	.....	22. Black	White	Red
5. Orange	.....	.....	23. White	Black	Red
6. Blue	.....	.....	24. Red	Black	White
			25. Green	Black	White
7. White	Black	.....	26. Orange	Black	White
8. Red	Black	.....	27. Blue	Black	White
9. Green	Black	.....			
10. Orange	Black	.....	28. Black	Red	Green
11. Blue	Black	.....	29. White	Red	Green
			30. Red	Black	Green
12. Black	White	.....	31. Green	Black	Orange
13. Red	White	.....	32. Orange	Black	Green
14. Green	White	.....			
15. Blue	White	.....	33. Blue	White	Orange
			34. Black	White	Orange
16. Black	Red	.....	35. White	Red	Orange
17. White	Red	.....	36. Orange	White	Blue
18. Orange	Red	.....	37. White	Red	Blue
19. Blue	Red	.....			

*Accepted by N.E.L.A. electrical apparatus committee at Virginia Beach, May 19, 1930.

†Accepted by N.E.M.A. power cable group at New York, August 28, 1930.

Tracer stripe scheme preferred

Time comparison tests on new, unsoiled cables were also conducted. When choosing colors under set A, the 50 per cent color combination group, it was discovered that considerable trouble was experienced. There being no predominating color to use as a base, the eye required a longer time to grasp the color distinction than in set B, which employed a base color and a tracer stripe. In the latter case the men would look first for the solid base color and then seek the tracer. The men expressed a decided preference for the tracer stripe scheme, claiming it is much easier to handle.

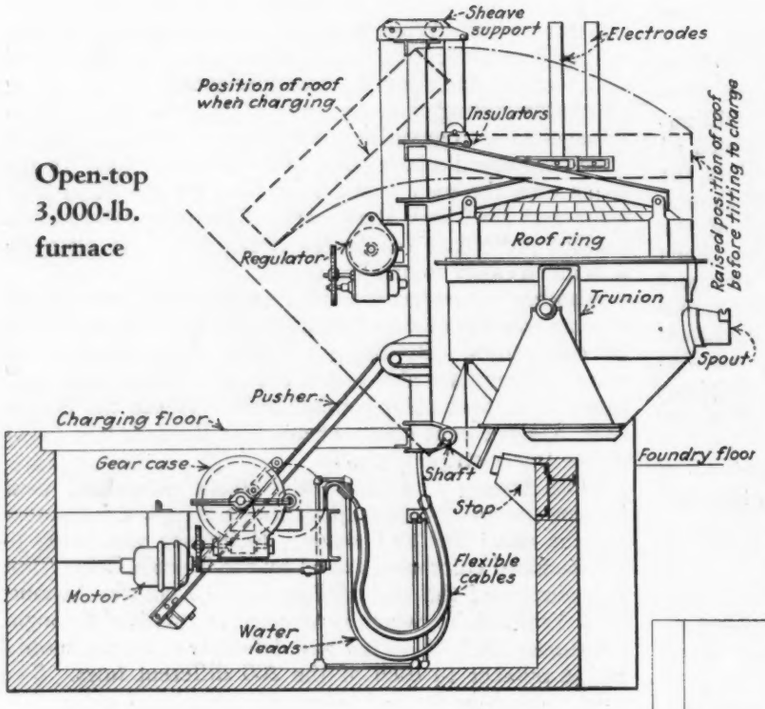
Another important reason for choosing the tracer stripe scheme was the ease in expanding the color group above 21 conductors. By using a tracer stripe method the manufacturers are able to make a cable having 100 separate and distinct color combinations. Hence the 50 per cent, 33⅓ per cent color scheme was discarded in favor of the tracer stripe method.

Once having determined the colors desired, it next became necessary to set up a definite standard for securing the exact hue and shade. Reference was made to the standard color card issued by the Textile Color Card Association of the United States, 200 Madison Avenue, New York, N. Y., which is accepted as standard throughout the textile field. This card definitely assigns a specification number to each of the 200 different hues. The joint committee studied this card and picked out a definite specification number for each of the five chosen basic colors—white, red, green, orange and blue—thereby automatically requiring all colored control cable manufactured in different parts of the country to be uniform in hue. By specifying a single number for each color there will be less difficulty in the field when matching colors of cables installed at various times and purchased from different manufacturers. The following numbers were chosen from the Textile Color Card:

Black	.....	Green	No. 60,105
White	No. 60,001	Orange	No. 60,039
Red	No. 60,068	Blue	No. 60,079

Another important element requiring a rigid specification was the width of the tracer stripe. If only one carrier thread were used, it soon became indistinct when soiled. Two threads improved the distinction a little better, but three carrier threads were found to be preferable. Hence it was written into the specification as ". . . the tracer stripe shall consist of three carriers . . ." On cables above 21 conductors another tracer stripe—also three carriers wide—is to run crossing the first stripe. The distinct choice of three carriers to form the tracer stripe avoids a possibility of confusing faded or dirty stripes, which would occur if only one colored carrier were used.

Favors Electric Furnaces for Special Steels

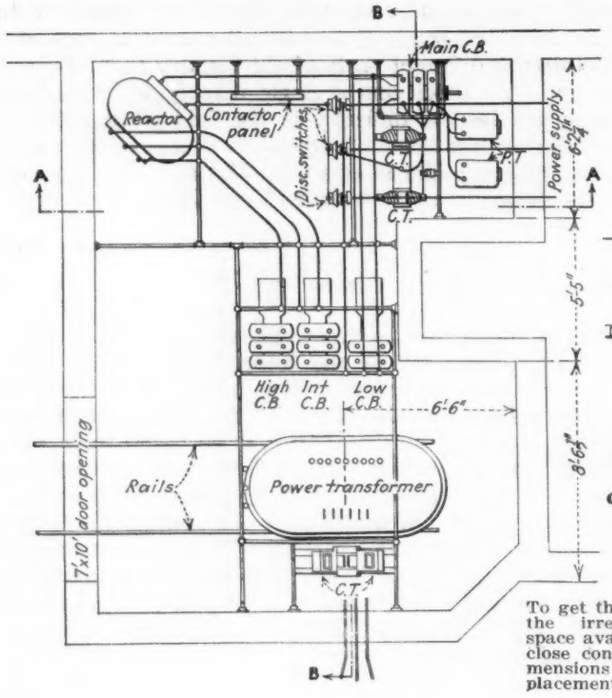


Open-top 3,000-lb. furnace

It tilts on trunnions instead of on rockers. It has a deeper and wider metal bath and consequently a greater melting capacity in proportion to its size. Single motor for pouring off and opening, multiple copper strips for electrode carrier connections without lateral sway below the floor, for safety and short length, and other details are identical in old and new units. This furnace, when melting, has a back tilt of 2½ deg. from vertical, which prevents spilling of capacity melts through the pour-off spout.

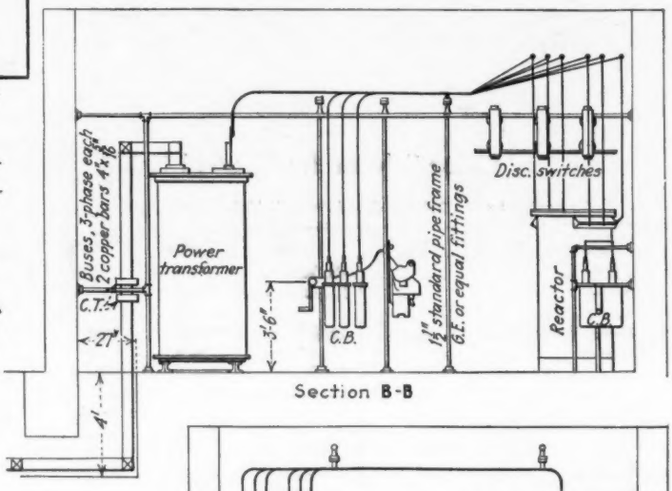
ACCORDING to David Evans, president of the Chicago Steel Foundry Company, no little part of the commercial success of his company's products is due to the electric furnace. Quoting him:

"It is not sufficient that the foundryman produce a satisfactory commodity part of the time. It is essential that he turn out dependable alloys day in and day out under all sorts of conditions. This requires a careful study of the mixture, strict grading of raw materials and accurate and painstaking



Supply and control room for new furnace

To get the apparatus into the irregularly shaped space available required a close consideration of dimensions and possible placements.



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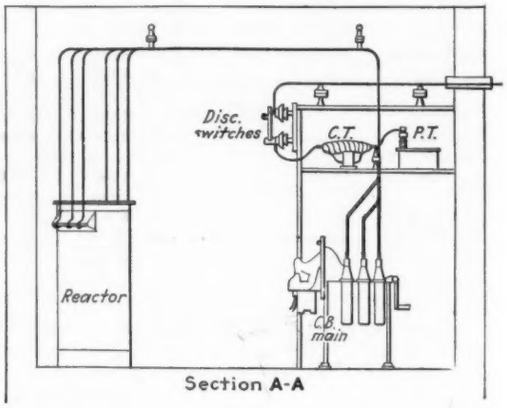
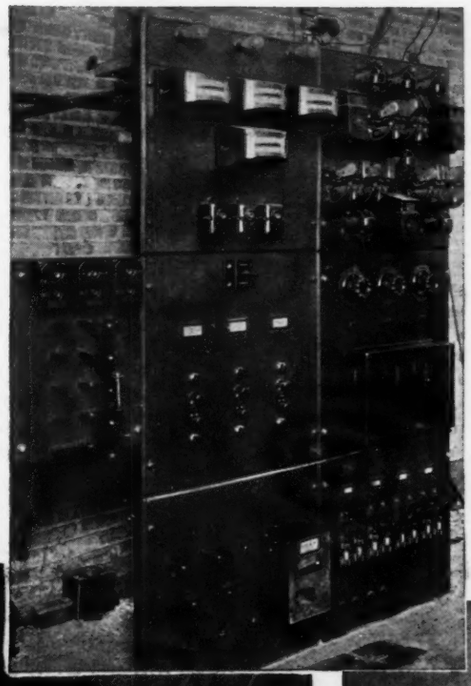


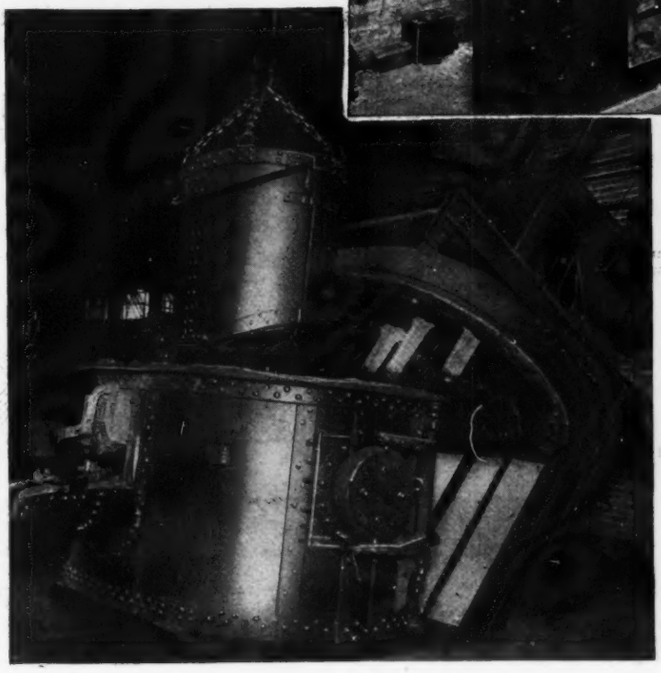
Section A-A

control of foundry practice. The electric furnace is an essential part of this picture because it combines the two qualities of close control and flexibility of operation, without which uniformity of product is something to be prayerfully hoped for rather than confidently expected."

Another advantage of the electric furnace that appeals greatly to the Chicago Steel Foundry Company is the exclusion of oxygen from the melting process. Chromium, largely used in alloying, combines readily with oxygen at melting temperatures. Also, it is an expensive metal. Therefore a melting process that insures the retention in the casting of the chromium that is added to the melt is distinctly advantageous.

Two special steels are made by this company. One is tradenamed "Pyrasteel" and is designed for high temperature uses. It resists oxidation and warping and retains high tensile strength at temperatures of the order of 2,000 deg. F. and higher. The other product is called "Evansteel" and is made in various grades of hardness, tensile strength and elastic limit. Both of these steels come under the classification of nickel chrome alloys.

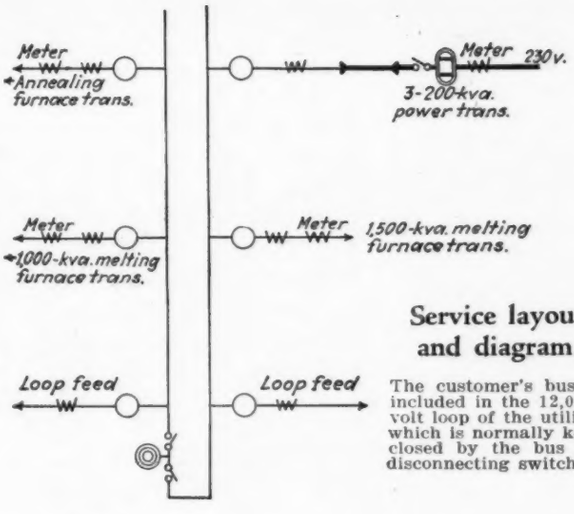




The furnace cycle

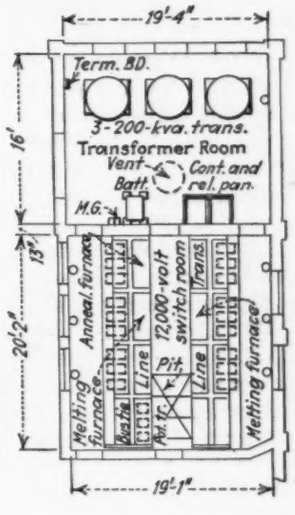
The charge is made in a single crane bucket operation and then the top moves back into place. The same motor and machinery that open the top tilt the whole furnace forward for pouring.

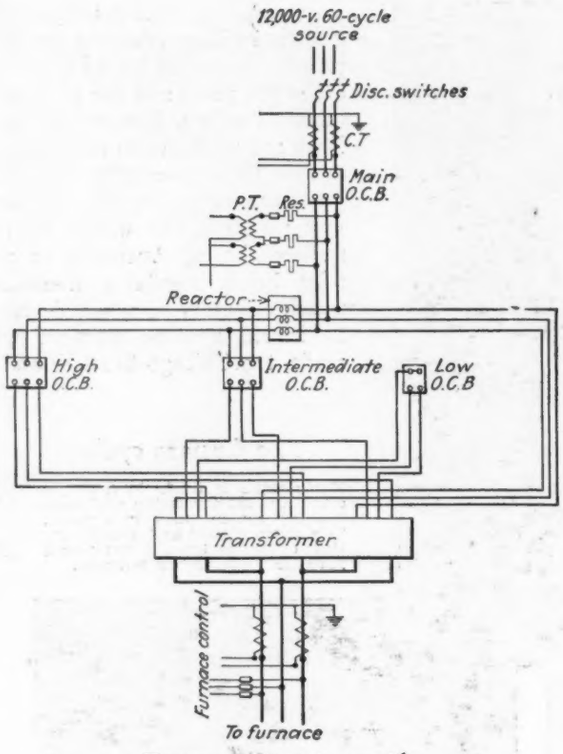
In making these alloys two electric melting furnaces are employed. One has been in use for about ten years and the other was installed only a few months ago. Both are of the open roof type, a design that apparently held out great promise at the time the first was installed, but which, by the mutabilities of business, is not now being regularly manufactured. However, when decision to install another furnace was made, the Chicago Steel Foundry



Service layout and diagram

The customer's bus is included in the 12,000-volt loop of the utility, which is normally kept closed by the bus tie disconnecting switches.





Furnace energy supply

Star-delta primaries on the transformers give to the older furnace high and low electrode voltages and to the new on high, intermediate and low through the use of extended windings on the star connection. The drawing shows the new installation. The furnaces are started under manual control and when arc stability is reached the automatic control is cut in. A reactor included in the circuits of the intermediate and high taps prevents excessive current surges. Control energy is direct current, 220 volts.

Company favored the design that had served so well for ten years and insisted that the new unit should be of the same type. Arrangement was made with L. C. Loshbough, formerly engineer of the Industrial Electric Furnace Company, now defunct, which had made the old furnace, for an electrical and mechanical design to be built and erected by the foundry company itself.

The new furnace now stands complete and operating, different in some small details (improvements), but otherwise identical with the first. The general features of the two furnaces are apparent from the accompanying pictures and drawings. The new furnace is expected to show an energy utilization of about 600 kw.-hr. per ton melted or better, including daily warming up of the furnace after overnight shutdown. Because the whole top of the furnace tilts back out of the way, charging is readily done, the sequence of opening the furnace, dropping in the charge from a crane bucket and closing requiring only about three minutes. The older furnace is capable of fourteen heats per day, each heat averaging 7,000 lb. of steel. The new one holds only 3,000 lb., but improvements in the design of the pot and a greater capacity of power utilization permit it to make faster heats.

Energy for furnace operation, general power and annealing casting is purchased at 12,000 volts, three phase, from the Commonwealth Edison Company. Service is from one of the Edison industrial loops and is underground. A Moore demand limitator is used.

The details of the energy supply and distribution are shown in the accompanying drawings.

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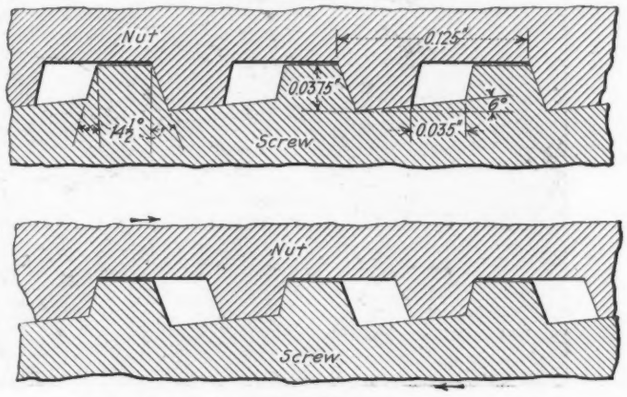
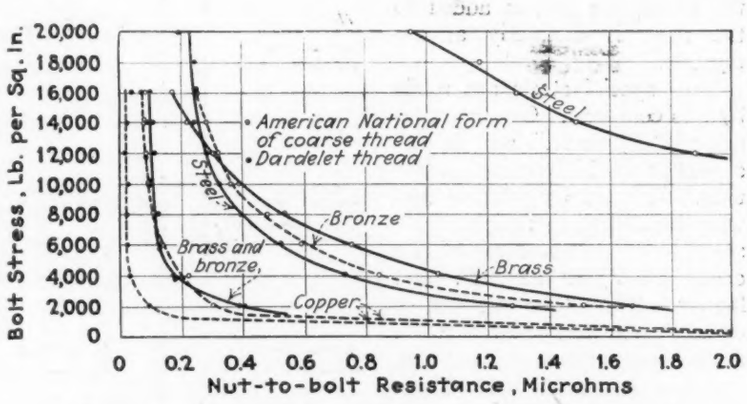
Bolt-Contact Resistance Reduced 75 per Cent

For stresses of 2,000 or more pounds per square inch in the bolts, the contact resistance between nuts and bolts is small, but that of the Dardelet thread is much smaller than that of the American National coarse thread, according to the Bureau of Standard Research Paper No. 227. For bolts of the same size and material under equal stresses in the bolt the contact resistance (between nut and bolt) of the American National coarse thread is, in general, more than four times the corresponding resistance of the Dardelet thread.

It should be remembered, the report points out, that these threads were well oiled. Experience with different types of sliding electrical contacts shows that usually the electrical resistance when oiled is about one-tenth the electrical resistance when dry. The contact resistance is defined as the difference in the electrical resistance of



Dardelet thread with nut in free and locked positions



Comparative contact resistances of Dardelet and American Standard thread

two specimens of the same material and dimensions, one being solid and the other consisting of two pieces (nut and bolt).

This thread was developed by the Dardelet Threadlock Corporation.

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READERS' FORUM

Surge Voltage Tests of Transformers

To the Editor of the ELECTRICAL WORLD:

In the issue of the ELECTRICAL WORLD for August 16, 1930, and in other American technical journals recently descriptions have been published of tests carried out on commercial power transformers to determine their surge dielectric strength. In these tests artificial lightning surges were sent into the transformer windings. After the lightning tests, the commercial induced voltage and other tests were repeated, and, presumably because these tests were satisfactory, the transformer was stated to be undamaged and in condition for shipment.

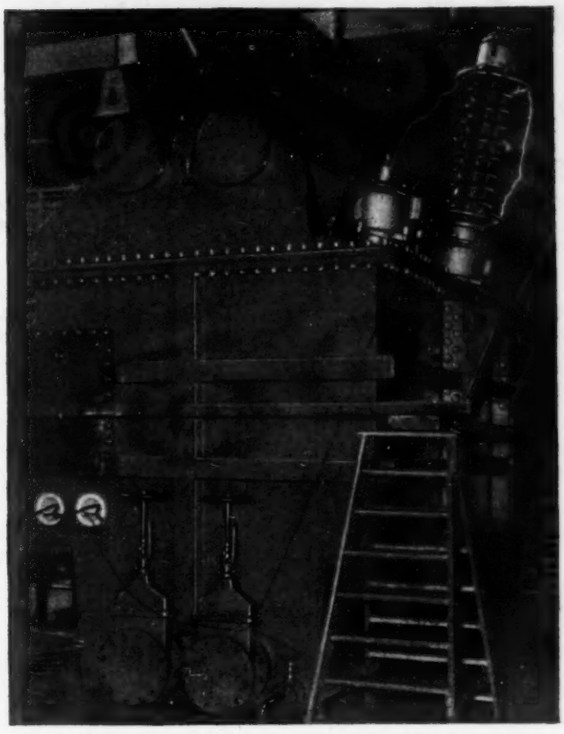
Generally similar tests were carried out at Hollinwood last May, July and October. The object of this letter, however, is not to dispute claims of priority, but to draw attention to the peculiar characteristics of surge breakdowns in transformers, and to show that pressure and overpotential tests are useless in determining whether or not a transformer has been damaged by surges.

The winding tested was one phase of a 60,000-kva., 132-kv., three-phase transformer. After 500 severe surges, there was no external indication that the windings had been damaged by the surge. However, on dismantling the windings and examining them, turn by turn, numerous places of breakdown and partial breakdown were found—all of them between turns and between coils. There was no sign of failure between the high-tension windings and either the low-tension windings or ground. The conclusions are:

1. That it is dangerous to assume that a transformer has been undamaged by surges because no evidence of failure can be determined by external inspection of the windings, or by overpotential tests or measurements of the magnetizing current.

2. That the damage was caused by the steepness of wave front of the surge rather than by its voltage amplitude, since it is the steepness of wave front which causes the most severe stresses within the windings. Protective devices which operate on the amplitude of a surge, such as most lightning arresters, are, therefore, inherently wrong in principle for transformer protection.

At the other end of the scale these tests were repeated a few weeks ago. A standard 25-kva., 11-kv. transformer was connected up to a short length of transmission line. The impulse flashover of the line insulators with the surge used was 230 kv. Surges were sent into the transformer through this line, of sufficient value just to flashover the line insulators, the flashovers occurring about once in every four surges. At the third surge and at each of the 27 subsequent surges smoke showed that the windings had broken down.



A 60,000-kva., 132-kv. transformer being subjected to surge voltage from artificial lightning generator

After the surge tests, which were made in the presence of engineers of one of the largest power supply companies in England, the windings were subjected to induced voltage tests at 2½ times normal for five minutes and to overpressure tests. Moreover, the magnetizing current at normal voltage was measured. There was no indication of any sort that the windings had been damaged by the surge.

When the windings were dissected fourteen separate places of breakdown were found, the worst being at the line end of the winding and the others at various points in the interior of the winding. All of the breakdowns were between turns, between layers or between coils. There was no sign of any failure or damage between the high-tension winding and ground or low-tension windings.

The tests were repeated on the second phase of the transformer with the windings protected by a standard Ferranti surge absorber. Twenty-four surges of 230 kv. were sent into the transformer, followed by 33 surges of 190 kv. No sign of breakdown was apparent, and after the tests the transformer was dismantled and the coils unwound turn by turn and carefully examined. There was no trace whatever of any damage.

E. T. NORRIS,
Chief Designer Ferranti, Ltd.
Hollinwood, England.

BOOK REVIEWS

The Fundamental Theory of Electrical Engineering

By Arthur Lemuel Albert, M.S., assistant professor of electrical engineering Oregon State College. Boston, Mass.: Ginn & Company. Engineering series, 323 pages. Price, $3.20.

This book has been prepared to meet a need for a comprehensive and yet readily comprehensible treatise upon electrical engineering fundamentals, serviceable to college and university students beginning serious work in this branch of applied science and also useful to non-electrical readers seeking to grasp the basic principles of the art. The introductory material is mercifully short, covering in a single chapter the mechanical principles analogous to vectorial applications and the use of vectors themselves. A well-condensed exposition of the electronic theory follows, after which attention is given to units of measurement, conductivity, electrochemistry, circuits, magnetic phenomena, direct and alternating currents, inductance and dielectrics.

There are many worth-while problems included, and the author has succeeded in avoiding mathematical complications to a striking degree, considering the quantitative nature of the book. Even to the engineer in the field the work presents a refreshing review of the underlying principles. The chapter on conduction through gases is especially successful in expressing clearly the basic phenomena of electronics. There are many helpful references and an excellent index.

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Die Elektrische Kraftübertragung

By Herbert Kyser. Berlin: Julius Springer. 544 pages, 440 illustrations.

This is a third and thoroughly revised edition of Volume I of a series of three. It deals broadly with motors, converters, rectifiers and transformers; the other volumes of the series cover the rest of the electrical system. Treatises on individual elements of an electrical installation are numerous. But the plant or operating engineer, for instance of a complete industrial installation, has to consider the entire energy system as an entity. Decisions must be guided by its performance as a whole, which involves interaction of the parts. That is the underlying idea of the book. Hence accessories are considered, as well as principal machines. The treatment is non-mathematical, full discussions being supplemented by charts rather than equations.

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Die Elektromagnete

By Erich Jasse. Berlin: Julius Springer. 196 pages, 117 illustrations.

Designers of apparatus utilizing electromagnets will constitute the group of readers whom this volume will primarily interest. The subtitle expresses the purpose and scope: "Fundamentals for computing magnetic fields and forces, especially with iron structures." The treatment is analytical within practicable limits set by the difficulty of computing the flux for long air-gaps and complicated paths. Researches by various investigators are quoted, particularly a series of tests on traction magnets with conical faces at various angles. A number of cases are worked out numerically. In addition to straight-action magnets, those having a lateral relative movement of armature and pole face are discussed as to the relation between conformation and force.

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Theory of Electrical Artificial Lines and Filters

By A. C. Bartlett. New York: John Wiley & Sons, Inc. 155 pages, illustrated. Price, $2.50.

Network circuits figure so largely in electric power, telegraphy and telephony, both wired and wireless, that artificial lines, line balances, filters and phase shifters are of great importance. The author deals with artificial lines, their theory and the several elements. The theory and applications are well developed.

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Artificial Sunlight

By M. Luckiesh. New York: D. Van Nostrand. 254 pages. Price, $3.75.

Dr. Luckiesh shows why and how safely it is possible to advance lighting from the stage of merely simulating the sun's aid in enabling us to see into the newer field of duplicating its curative and health-sustaining values. All essential researches of others have been combined with the extensive results acquired under his own direction. The proportion of ultraviolet energy in solar radiation, the effects of all the spectral energies, the biological and therapeutic influences of the ultraviolet are assembled so that illuminating engineers intent on engaging in dual-purpose lighting may proceed in the light of physical and physiological knowledge. The final chapters record the data on ultraviolet reflecting and transmitting media and discuss the stability of color of glasses, fabrics, etc., subjected to the rays. The last chapter deals with the fixtures and installation of dual-purpose lighting.

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Gestehungskosten und Verkaufspreise elektrischer Arbeit

By Fr. Brock. Vienna: Julius Springer. 48 pages, 20 illustrations. Price, 4.80 reichsmarks.

The author's 30 years' experience is evident in his manner of dealing with electrical production costs and rate structures. His simple and essentially non-mathematical presentation of the elements that go into the making of a rate structure for electricity should interest not only the seller but, equally, the purchaser of electrical energy. Under the item of cost, the effect of proportionate peak demand is shown. The section on cost is followed by one on rates; finally, the effect of power factor in industrial loads is investigated. This leads to a three-part industrial rate which, the author assures us, is fair, simple and entirely practicable as to metering, as found by experience.

Men of the Industry

F. W. Peek Chief Engineer of Pittsfield Works

FRANK W. PEEK, JR., has been appointed chief engineer of the Pittsfield works of the General Electric Company, effective January 1. Mr. Peek is at present chief engineer of the transformer engineering department of the company and is internationally known for his researches in high-voltage engineering and investigations of corona lightning phenomena, insulation and transmission practice. He is a native of California, was educated at Leland Stanford University and has been in the employ of the General Electric Company since 1905. His pioneering work in the high-voltage field has ranged widely from laboratory to line determinations of epochal importance.

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E. J. INGRAM has been appointed lighting engineer of the Public Service Company of Northern Illinois and W. S. E. MILLER has been named assistant illuminating engineer.

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PERCY C. DRAKE, formerly assistant treasurer of the Montreal Light, Heat & Power Consolidated, has been appointed treasurer of that company to succeed G. Chagnon, who has retired because of ill health. Mr. Drake has been associated with the Montreal utility since 1906, and in the course of this period of time he has acquired an extensive knowledge of the company's varied affairs.

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CLOYD M. CHAPMAN, engineering specialist of New York City, was re-elected to the vice-presidency of the American Standards Association for the year 1931. Mr. Chapman entered the employ of Thomas A. Edison in 1899 as assistant in his private laboratory on experimental work. He has been engineer for Westinghouse, Church, Kerr & Company in charge of design and construction work and of tests. His work has includeed the design and construction of a number of important central stations and industrial plants.

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FREDERICK E. MINDT has been appointed electrical engineer of the Public Service Commission of New Hampshire, succeeding Lyman E. Bigelow, resigned. Mr. Mindt is a native of Bath, Me., and his experience includes varied service with the Manchester Traction, Light & Power Company of New Hampshire, Amoskeag Manufacturing Company of Manchester, Westinghouse Electric & Manufacturing Company, New England Power Company and Stone & Webster, besides industrial connections at Nashua.

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C. E. Allen New Westinghouse Vice-President

CLAXTON E. ALLEN, who was elected a commercial vice-president of the Westinghouse Electric & Manufacturing Company, as announced in the December 20 issue of the ELECTRICAL WORLD, has been associated with the Westinghouse organization since 1909.

After attending high school in Virginia he was graduated with the degree of bachelor of science in electrical engineering from the Virginia Polytechnic Institute in 1901. His first position with Westinghouse was as head of the transformer division of the detail and supply department. Three years later he was appointed assistant to manager of that department. For a short time in 1915 he was attached to the sales department of the New York district office and then was made manager of the supply division and central-station division of the Chicago office, which position he held until 1922, when he was appointed manager of the St. Louis district office.

In announcing the election F. A. Merrick, Westinghouse president, stated: "The distribution of our products which pass through merchandising channels has made substantial growth in recent years and in order to further the effectiveness of our efforts in these lines through more definite co-ordination of the various activities involved it has been decided to provide a general direction in the entire field of this class of distribution.

"Mr. Allen's duties of co-ordination will extend over the domestic appliance division and other divisions serving the household market, such as refrigeration, radio, etc., and also the jobbing outlets, and other outlets as may be appropriately developed."

Mr. Allen is a fellow of the American Institute of Electrical Engineers and has been vice-president of the St. Louis Electrical Board of Trade. He has assumed his new duties with headquarters in East Pittsburgh.

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GEORGE H. HOWARD, president of the United Corporation, was elected a director of the Public Service Corporation of New Jersey and underlying companies at a recent meeting of the board. Mr. Howard replaces Samuel T. Bodine, who was one of the original directors of Public Service when it was organized in 1903. Mr. Bodine, however, resigned in 1923 and was re-elected two years later. Mr. Bodine is a former president of the United Gas Improvement Company of Philadelphia and is now chairman of that company's board. His resignation leaves but three of the original board still serving—Thomas N. McCarter, Uzal H. McCarter and General William C. Heppenheimer.

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HORACE P. LIVERSIDGE, vice-president and general manager of the Philadelphia Electric Company, has been elected president of the Electrical Association of Philadelphia by the board of governors. The other officers elected were: Vice-president, Frank R. Elliott, president Elliott Lewis Electric Company, Inc.; secretary, Joseph D. Israel, district manager Philadelphia Electric Company; treasurer, Philip H. Ward, Jr., president Ward Electric Company. In accepting the leadership of the association, Mr. Liversidge stated that "since its inception in 1922 the Electrical Association of Philadelphia has progressed from a small social organization to a strong promotional group. While the records of the Electrical Association are full of accomplishments in the past two years,

the growing utilization of electricity by industry, business and the home indicates that the coming year will be one of intense activity for the association."

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ARTHUR N. SAINTE-MARIE, publicity manager of the Montreal Light, Heat & Power Consolidated, has been appointed assistant treasurer of that company with jurisdiction over the public relations department. Joining the Montreal Light, Heat & Power as public relations manager in 1925, Mr. Sainte-Marie has been identified with the public relations, advertising, customer-ownership and employee welfare work of the company. He is well known in publicity and business circles, having occupied responsible positions with the leading English and French newspapers of the city. Mr. Sainte-Marie is a past-president of the Montreal Publicity Association (now the Advertising Club of Montreal), of which he was a director for many years. He is also a member of the Montreal Board of Trade, the Chambre de Commerce de Montreal and a number of other business, trade and public utility associations.

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LESLIE WEISS, general manager of the Easton-Dover division of the Associated Gas & Electric Company, has been appointed general sales manager for the entire Pennsylvania-New Jersey System, extending from Union Mills, Md., to Dover, N. J., with headquarters at Reading, Pa. Mr. Weiss has been general manager of the New Jersey Power & Light Company since 1928. He is a graduate of the Armour Institute of Technology, Chicago. After receiving his degree in engineering he spent two years with the General Electric Company as test engineer at the Schenectady and Pittsfield laboratories. For several years thereafter he was associated with Gannett, Seelye & Fleming, consulting engineers, Harrisburg, Pa., in the development of electric light and power companies in northern Pennsylvania and Virginia. He became associated with the Barstow group of properties ten years ago and for three years prior to removing to Easton was sales manager for the Reading district of the Metropolitan Edison Company.

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C. A. WOLFROM, newly elected president of the Electrical League of Utah, first became associated with the power and light industry in 1902, when he went west from Ohio and entered the employ of the Telluride Power Company. From 1903 to 1905 he was operator and plant superintendent of the Provo and Olmsted plants, which were at that time owned and operated by the Telluride company. During the three years 1906, 1907 and 1908 Mr. Wolfrom attended the University of Michigan, pursuing a course in mechanical engineering. In the latter part of 1908 he again removed to the west and was engaged in reconnaissance survey work on various streams in California for the late L. L. Nunn. From 1909 to 1913 he was superintendent of the Grace plant of the Telluride company. In 1913 he was placed in charge of the Utah Power & Light Company's Wheelon plant on Bear River, and also of its distribution system in its Garland and Tremonton territory. Subsequently he served as assistant to the operating manager, with headquarters at the general offices in Salt Lake City, manager of the Idaho Falls division, manager of the Provo division, and in September, 1927, he was advanced to the position which he now holds, that of manager of the power company's Salt Lake division.

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JOHN R. GEARY, after 41 years of service with General Electric interests, including the past 27 years as representative of the company in Japan, has retired from active duty. He expects to remain in Japan for some time and will continue to serve as a director of the Tokyo Electric Company, Ltd., and the Shibaura Engineering Works, Ltd. Mr. Geary entered the employ of the Sprague Electric Railway Motor Company, one of the predecessors of the Edison General Electric Company, through the merger of which with the Thomson-Houston Company the General Electric Company was formed. After some years in the accounting department at Schenectady, he joined the foreign department in 1899. In 1901 and 1902 he was with the British Thomson-Houston Company in England. Upon his return to this country he was selected in 1903 to represent the General Electric Company in Japan, where at that time the company's business was being conducted through agents and without a local office. Mr. Geary was instrumental in fostering and extending the relationships of the company with Japanese industry through an affiliation with the Tokyo Electric Company, Ltd. For many years Mr. Geary has been a director of both companies, and for some time he was also president of the Tokyo Electric Company, Ltd.

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OBITUARY

LIEUT.-COL. REUBEN W. LEONARD, Canadian engineer and philanthropist, died December 17 in his seventy-first year. Colonel Leonard was identified with certain electrical developments at Niagara Falls and was for years president of Coniagas Mines, Ltd., one of the richest silver mines in the Cobalt area. He was an active member and at one time vice-president of the Canadian Society of Civil Engineers and the Canadian Mining Institute. He served also as president of the Engineering Institute of Canada during 1919-20. His interest in the engineering profession extended to foreign technical societies, including the Institute of Mining and Metallurgy of London, England; the Institution of Civil Engineers, also of London, and the American Institute of Mining Engineers. In the course of an extremely active and useful career Colonel Leonard found time to devote himself to the cause of education, having held positions on the board of governors or as a trustee at various institutions of learning such as the University of Toronto, Queen's University, Wycliffe College and similar institutions.

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WILLIAM C. WILLARD, banker and a director of the Columbus (Ohio) Railway, Power & Light Company, shot himself at the Athletic Club in that city December 11. Mr. Willard, who was 58 years of age, had been in ill health for three years. He had been connected with a number of railroads and other business enterprises.

F. M. REIGHNER, supervisor of the maintenance department of the Carolina Power & Light Company at Raleigh, N. C., was instantly killed when his automobile collided with a truck 2 miles south of Florence, S. C. Mr. Reighner had been employed by the local branch of the Carolina Power & Light Company since 1926, having removed there from Allentown, Pa. He was formerly connected with the Western Electric Company in Philadelphia.

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EUGENE B. EDWARDS, manager of the Northampton (Mass.) Electric Lighting Company, died in Mount Sinai Hospital, New York, December 16, after an illness of more than a year. Northampton was Mr. Edwards' native city. He had been connected with the Northampton utility for nineteen years, and since 1921 he had served in the capacity of manager.

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DR. ING. H. GÖRZ, a leading German electrical engineer, died recently in Berlin at the age of 69. After being for some years with the Allgemeine Elektrizitäts Gesellschaft, Dr. Görz took over the management of the Siemens branches in Leningrad. On the outbreak of war he returned to his native country and rendered yeoman service to the German government. For the past twelve years he has occupied an important position on the boards of the Siemens & Halske and Siemens-Schuckertwerke organizations.

Financial and Statistical News

ISOLATED liquidation continues under way in nearly all markets as the year draws to a close. Utility stocks have been sold heavily, although a few issues seem to have touched resistance levels. Short covering has been heavy in recent sessions. Opinion differs sharply as to whether or not the market has already or is now discounting unfavorable fourth quarter reports. No one doubts but that many disappointing quarterly statements will have to be faced early in the year.

——THE DEFINITE TURN UPWARD that the bond market made last week has been very well sustained and many issues have made substantial gains. Utility bonds have shared the upward movement.

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Ohio Utility Changes Name

THE GREENVILLE ELECTRIC Light & Power Company has asked authority of the Ohio Public Utilities Commission to change its name to Western Ohio Public Service Company and to set up a capital structure of $6,000,000, divided into 10,000 preferred and 50,000 common shares, both of $100 par value. The company has also applied for permission to acquire the Bradford & Gettysburg Electric Light & Power Company, the Brookville & Lewisburg Lighting Company, the Buckeye Light & Power Company, the Eaton Lighting Company, the New Madison Lighting Company and the Western Ohio Public Service Company.

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Foshay Properties Earn Bond Interest

BOND INTEREST IS BEING EARNED by Public Utilities Consolidated Corporation, but the outlook for the stock is less favorable, according to Joseph Chapman, receiver for the properties.

Outstanding bonds amount to over $9,000,000. As of October 31, 1929, there were 89,597 shares of $100 par preferred stock outstanding, carried on the books at $8,959,700. The preferred is indicated to have had an asset value of $5,113,247 as of September 30, 1930. Public Utilities Consolidated Corporation as of October 31, 1929, had no-par A and B stock outstanding of values, as appearing on the company's books, of $6.520,101. The receiver's report indicates that the A and B stock has practically no value.

Public Utilities Consolidated Corporation has heavy nominal obligations due it from the W. B. Foshay Company, but the receiver's report indicates a realizable possibility not exceeding 5 cents on the dollar.

In the scaling down process as shown in the treasurer's report there were heavy eliminations in connection with the sale of Georgia and Canadian property and heavy scaling down of Vermont property. Against this there was some cash realization. Further important eliminations were made. The relationship between Public Utilities Consolidated Corporation and W. B. Foshay Company was found by the receiver to be exceedingly involved. The E. C. Warner claim for $500,000 and the American Trust claim of $500,099 have been set for trial January 12, 1931.

Under the receivership, which still continues, 9,364 claims totaling $1,729,601 have been filed with the clerk of the District Court. The Master in Chancery in the first six schedules totaling $313,599 recommended that all of such claims be disallowed on the grounds that most of the claims covered dividends declared in October, 1929, and payable in November, when the Master said the company had neither earnings nor surplus out of which they could have been legally declared.

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Stock and Cash Dividends Both Have Their Merits

THE relative merits of stock and cash dividends has again been the subject of mild discussion following the switch by American Water Works & Electric Company to the payment of cash dividends. Contrary to press reports, however, there is no controversy whatever. The board of directors, believing that the earnings, prospects, and financial condition of American Waterworks & Electric warranted payment of cash dividends on common stock at the rate of $3 a share annually, substituted this for the rate formerly paid, of $1 in cash and 5 per cent in stock.

The stock dividend policy was adopted by several of the utilities largely during a period when expansion programs were being carried out at a rapid rate and had to be financed. The payment of dividends in stock allowed these companies to retain the equivalent cash that would otherwise have been paid out to stockholders and to turn it back into the system. This was a substitute for public financing which would in many cases have been more costly.

While the merits of the stock dividend may be regarded by some as more obvious in a period of rapid expansion and steadily increasing earnings, many leading corporations see fit to retain it through periods of less favorable business conditions such as now exist. Among the utilities now paying part or all of their dividends in stock are North American Company, Electric Bond & Share Company, American Gas & Electric Company, American Power & Light Company, Middle West Utilities, etc. The position of one of these, North American Company, has been set forth by President Frank L. Dame in making clear that that company has no intention of changing its policy. The viewpoint is probably representative.

Mr. Dame said:

"There is a constant increase in demand and a constant need for funds to finance the construction of new service facilities. The North American Company's subsidiaries are spending over $60,000,000 for construction in 1930, which is considerably more than the estimated expenditures reported a year ago to President Hoover.

"Inaccurate speculation as to the North American Company's stock divi-

dend policy has resulted from observers overlooking the following facts:

"First—Taken at its old par value, the proportion of North American common stock to total capitalization of the company and its subsidiaries has not increased—but has decreased from 12.07 per cent to 11.15 per cent—since we began paying stock dividends in 1923. This is true in spite of the fact that common stock outstanding has increased 167.5 per cent, of which 129.5 per cent was due to dividends and 38 per cent was issued for cash and for the purchase of properties, including Mississippi River Power Company and Western Railway & Electric Company. Meanwhile, earnings increased 313.9 per cent.

"Second—The book value of North American common stock has consistently increased, and the earnings trend per share since the inauguration of the dividend policy has been upward.

"Third — The amount the company retains by payment of dividends in stock averages about 10 per cent of the annual expenditures for new facilities. The amount retained enables the company to increase its investments in the common stock of its subsidiaries and keep their capital expenditures balanced so that bonds and preferred stocks may be sold at the most favorable rates. It is sound practice to increase common stock in proportion to other capitalization."

Whether or not those companies now paying stock dividends intend to continue the policy indefinitely, there is an impression among observers that as yearly net profits grow less rapidly, this constant increase in stock may lead to dilution. The impression among utility executives, however, is that the power and light industry is in no immediate or near-future danger in this respect. In any event the situation in which an individual company finds itself determines its policy. There is obviously no "best policy" to apply equally to all, in the matter.

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Pacific Gas & Electric Payroll Up in 1930

PACIFIC GAS & ELECTRIC COMPANY had a payroll of $27,401,000 for the past eleven months and had 235 more people on its payroll in November than a year before.

According to President Hockenbeamer, "Notwithstanding the normal tendency for employment to decrease as winter approaches and construction activities slacken, Pacific Gas & Electric Company's November payrolls were substantially at the maximum for the year. The total number of full-time employees in November was 15,909, as compared with 15,674 in November of the preceding year, an increase of 235. Total payroll disbursements in November amounted to $2,406,000, and for the eleven months to November 30 were $27,401,000. Total payroll disbursements in these eleven months exceeded the same period of the preceding year by more than $4,000,000. The same properties are included in both periods.

"The company is shaping its construction plans to permit of the retention of present forces and the maintenances of payrolls at the present level to the greatest possible degree."

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Porto Rico Utility Issues Debentures

THE PORTO RICO POWER COMPANY, Ltd., recently made an offering of twenty-year sinking fund gold debentures to the amount of $2,000,000, the price being 94 and interest, to yield about 6.55 per cent. This company was incorporated as the Porto Rico Railway Company, Ltd., under the laws of the Dominion of Canada in 1906 and its name was changed in November, 1930. It owns through a wholly owned subsidiary the electric lighting and power distribution systems in San Juan, Porto Rico, and in 31 other communities in the eastern section of the island.

The proceeds of this issue will be applied to retire advances in connection with construction of the Rio Blanco hydro-electric development and for general corporate purposes.

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Canadian Output Off 3 per Cent

CENTRAL STATIONS IN Canada generated 1,549,286,000 kw.-hr. in October, according to returns compiled by the Dominion Bureau of Statistics. This was 8.4 per cent more than in September, but 3 per cent less than in October, 1929.

Of the production generated by water power, the Maritime Provinces accounted for 33,428,000 kw.-hr., as compared with 32,682,000 in the preceding month and 16,597,000 in the same month a year ago. The change is due principally to the increased power requirements of the Mersey Paper Company and the New Brunswick International Paper Company. Output of the other areas, in thousands of kilowatt-hours, together with comparative figures for October, 1929, follow: Quebec, 769,063 (813,794); Ontario, 521,991 (529,568); Prairie Provinces, 88,717 (105,049); British Columbia, 111,374 (94,034).

Export of electric energy during October reached the highest point for any month recorded in some years, the total being 161,323,000 kw.-hr. This is, roughly 8,000,000 kw.-hr. more than in September and nearly 35,000,000 kw.-hr. over October, 1929.

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Baltimore Industrial Load Gains 4 per Cent

INDUSTRIAL POWER SUPPLIED to local industry by the Consolidated Gas, Electric Light & Power Company during the first ten months of this year, as against the same period of last year, shows an increase of 4.28 per cent. The figures presented are strictly for industrial power and do not include domestic and other users.

The kilowatt-hours which are supplied to local industry, less two large industries whose consumption varies greatly under all conditions, are given in the following tabulation:

	1930	1929	Per Cent Increase
First six months	231,952,166	216,306,167	7.23
July	37,586,559	37,227,971	0.96
August	38,131,554	39,350,226	—3.10
September	38,969,903	37,124,060	4.13
October	37,894,879	38,427,914	—1.39
	384,535,061	368,736,338	4.28

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NEWS BRIEFS

At a meeting of the board of directors of the General Public Service Corporation Harry A. Arthur, vice-president of American International Corporation, and Joseph S. Lovering, vice-president of Central Hanover Bank & Trust Company, were elected to the board to fill the vacancies created by the resignations of Frederick P. Royce and Charles E. Ober.

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Minnesota Northern Power Company recently offered an issue of 7 per cent cumulative preferred stock (with common stock purchase warrants). Stock may be paid for in full at time of subscription or in monthly installments of $10 per share with order and the balance of $10 per share per month. Proceeds of this issue will be used to pay indebtedness incurred in extensions and development already completed and for other corporate purposes.

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Philadelphia Electric Company has called for redemption January 1, 1931, first lien and refunding mortgage 5 per cent gold bonds to the amount of $90,-

500. The maturity date on these securities was 1960.

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First and refunding mortgage 5 per cent gold bonds of the Androscoggin Electric Company have been offered at 98¼ and interest, yielding more than 5.50 per cent, a piece of financing involving a total of $873,500. The Androscoggin Electric Company does the entire commercial electric light and power business in the cities of Lewiston and Auburn, Me., and vicinity, serving a population of 58,923. The company is directly connected by transmission line with the Central Maine Power Company. These bonds dated October 26, 1914, mature October 1, 1934.

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Directors of the American Water Works & Electric Company, Inc., have declared a quarterly dividend of 75 cents per share on the common stock, payable February 2, 1931, to holders of record January 9. Previously, the company made quarterly cash distributions of 25 cents per share, and in addition, on February 15 and August 15, 1930, paid semi-annual stock dividends of 2½ per cent on the common stock.

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Recent Listings

NEW YORK STOCK EXCHANGE has authorized the listing, on or after January 2, of 154,203 additional shares (no par value) common stock of the North American Company, on official notice of issuance as a stock dividend, making a total of 6,914,028 shares applied for to date.

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The Exchange has also authorized the listing of twenty-year 5½ per cent first (closed) mortgage sinking fund gold bonds of the Ontario Power Service Corporation, Ltd., to the amount of $20,000,000. These bonds are due July 1, 1950.

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Sweden's Utility Ownership Centralized

THROUGH THE ACQUISITION by General Swedish Electrical Company of the Luth & Rosen Electrical Company, 80 per cent of the entire high-tension electrical industry of Sweden is under the control of one company.

The former firm is now the largest enterprise of its kind in northern Europe. At present its capital stock is 75,000,000 kronor. It was established 47 years ago in Arboga and ten years later moved to Vesteras, in Central Sweden, where it is still located. J. S. Edstrom is president. The company owns mines, forests, cable works, iron and steel factories, a paper mill and a steam turbine plant, besides its huge electrical plants. It also maintains important manufacturing units in England, Norway and Russia and a net of subsidiary companies, agencies and sales offices in not less than 44 different countries.

The output consists of generators and transformers, motors, electrical locomotives, tramcars, elevators, cranes and switches. The company specializes in the electrification of railways and mills of all kinds, the building of power stations, transmission and hydro-electric plants, etc.

General Swedish Electrical Company also controls two important financing and exploitation companies, the Electro-Invest and the Aktiebolaget Skaninaviska Elektricitetsverk. These concerns were formed for the organizing or financing of enterprises in the electrical field. The former operated in foreign countries, while the latter confines its activity mainly to Sweden.

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New England to Speed 1931 Construction

CONSTRUCTION to the amount of $21,000,000 has already been budgeted for 1931 by the Boston Edison company and New England Power Association, according to statements issued by C. L. Edgar and Frank D. Comerford, presidents of these organizations. Mr. Edgar declared that the letdown in business has been less apparent in New England than elsewhere and expressed confidence in a healthy, normal growth of power revenue in the coming year. Although the use of electricity in industries fell off, the consumption of energy in the home increased substantially. Electric appliance sales kept up with the 1929 record; refrigeration and range sales made an unusual advance, and both industrial and display lighting were very active. New applications of electric heat also aided the situation.

"Throughout the year," said Mr. Edgar, "the Edison company's progress has reflected the steady, sound development that has always characterized New England's growth. During the past year we have not reduced wages. Our construction activities employing labor have been possibly greater than usual. Some of our routine work, like pole line and underground conduit construction, must of necessity be done between April 1 and November 1, but with the exception of fluctuations of this character, our working forces have been maintained and our seasonal activities will be resumed in the spring." The major budgeted items for the Boston company are, in round figures, for 1931: Electric generating station additions, $450,000; transmission lines, $500,000; substation additions, $1,900,000; steam heating station and additions, $2,000,000; completion of general office building, $250,000; additions to distribution system, $5,000,000. Additional construction will result from plans developed during the year.

"During this depression," said Mr. Comerford, "electric company revenues have suffered, yet they have taken the lead in new construction. Their purpose has been to employ as many men as possible, to buy materials and supplies and help bring back prosperity. As its part of this program the New England Power Association will spend about $12,000,000 for construction, extensions and additions. Construction that normally would not have been done for several years is being expedited to help the general situation. Today the electric industry is actually employing more people than at any time in the past. Wages are as high as and in many cases higher than ever before. I know of no other industry to which these two conditions apply. Our industry always has had and probably always will have critics. We do not complain of this. If we make mistakes we should be called to account, but we believe it is only just that these critics now and then should give credit where credit is due, and should not entirely overlook the distinct public service which the electric company can and does render in a vast majority of cases."

Turners Falls Power & Electric Company, Turners Falls, Mass., will enlarge its 66,000-volt station at Turners Falls to 115,000 volts at a cost of approximately $1,000,000, according to President Lawrence. New installations will include a 32,000-kva. transformer, a 30,000-kva. transformer, eleven 115,000-volt oil circuit breakers, six 66,000-volt oil circuit breakers and other necessary equipment. The plant will be operating on enlarged basis June 1 and all work completed by September 1. Pursuant to this improvement the transmission lines running from Turners Falls to Springfield will be raised from 66,000 to 115,000 volts. A similar change has been authorized on the lines between Agawam, Mass., and Hartford, Conn., and between Turners Falls and Pittsfield, Mass.

Business News and Markets

Europe Has Adopted Our Methods in Fight for World Trade

"IF AMERICAN standards of living are to be maintained we must adhere to a tariff capable of protecting us against the lower standards of continental Europe," declared C. C. Chesney, vice-president of the General Electric Company, to a representative of the ELECTRICAL WORLD this week. "I see no other way in which American markets can be saved for American manufacturers in face of the increasing competition European manufacturers are achieving in these difficult times."

Mr. Chesney has just returned from a four months' trip to Great Britain and the Continent, during which he visited a large number of electrical manufacturing plants, and his observations as to the status of the electrical manufacturing industry abroad were requested in view of his long experience as an executive in this field. "With a few exceptions only," said Mr. Chesney, "I found electrical factories in Europe running at about 50 per cent of their capacity. These exceptions were the Alsthom plant in Belfort, France, and the Ceskomoravska-Kolben-Danek plant at Prague. France is making active use of the reparations fund and her population is hard at work. Men, women and children work long hours and practice the utmost thrift. As for Czechoslovakia, industry and agriculture are well balanced there and the country is rapidly taking advantage of the progress of science and engineering to build up its material resources. In its reorganization from the status of a somewhat backward country, it is turning to electrical methods and is finding itself developing manufacturing on a substantial scale.

C. C. Chesney

Foreign plants well equipped

"Contrary to the impressions held by some on this side of the water, many of the manufacturing plants abroad are well equipped for volume production and the lower scale of wages obtaining is a potent factor in competition against the United States in the electrical machinery field. Good factory buildings with excellent lighting are to be found, and especially in Germany, Great Britain and Switzerland the quality of machinery produced is equal to what we are accustomed to at home, unless in certain highly specialized equipment. Machine tools of the best modern design with individual motor drives and flexible control apparatus are widely used, and at present it is extremely difficult for American manufacturers to obtain business overseas in this field.

"The internal manufacturing arrangement of many European plants are in need of modernization and are gradually receiving it. Maximum wages are about 60 per cent of those prevailing in this country and minimum wages about one-third of ours. In the use of the telephone American manufacturers have in the past had some advantage over their foreign competitors, but conditions are changing abroad and this means of saving time and labor is spreading on the other side.

"Three storm centers in Europe at present render the outlook uncertain," said Mr. Chesney. "Russia is dumping her wheat elsewhere and is in a state of flux, the outcome of which is hard to predict. It is unlikely that the grandiose plan of the Russian government to industrialize the country in a five-year period will have much effect on international competition at present. There is a large group in Germany which is disposed to avoid war reparations payments and in Italy there is much economic uneasiness. I can see no easy reconciliation between American and European standards of living, and as the present spread in labor costs exists international competition is bound to be of the keenest sort. Our outlook for foreign trade is faced by prices based on lower living standards and hence lower costs. Mexico and South America would seem to be our best fields for cultivation, outside of Canada, and even here we must face the facts of competition from manufacturing concerns abroad which have adopted the methods which have proved so successful here."

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Public Service of New Jersey Peak 540,500 Kw.

ON WEDNESDAY AFTERNOON, December 17, at about 5 o'clock, a new record for the Public Service power system was established when the demand for electricity rose to a total of 540,500 kw. This exceeded the company's previous peak-load record of 536,600 kw., made on the afternoon of December 16, 1929. In 1928 the peak load amounted to 486,500 kw., which also established a record up to that year.

The demand upon the company for electricity reached its peak as usual on a cloudy day during December, when days are shortest. The peak-load results from a demand for electricity to light offices, factories and homes, occurring before industrial concerns in the territory had shut down for the day.

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Employment Plan in G. E. Lamp Department

A STABILIZATION OF EMPLOYMENT plan, whereby employees of the incandescent lamp department of the General Electric Company of not less than two years continuous service will be guaranteed 50 weeks' work for the year 1931, was announced today by President Gerard Swope and will become effective January 1, 1931, upon acceptance by 60 per cent of the eligible employees.

"Stabilization of employment," explains Mr. Swope, "is much simpler in those departments where the product has been standardized and where there is less risk of obsolescence and deterioration. The product of the incandescent lamp department is notably one of these. The plan for a guarantee of work under certain conditions is offered as a result of the stabilization of production and employment in the incandescent lamp department. It is hoped that the plan may be continued from year to year, possibly with modifications resulting from experience."

Under the conditions of the employment stabilization plan, a week's work shall comprise the normal working hours per week for each division, department, factory or activity as defined by its manager and subject to change by him, but in no case shall it be less than 30 hours' work in any calendar week, except as affected by deductions for holidays, illness of the employee, or through fire, flood, strike or other extreme emergency. Subject to such terms, full payment will be made to employes for 30 hours' work in case of employment for less than 30 hours in any calendar week.

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TRADE BRIEFS

The various plastic activities of the General Electric Company have been co-ordinated into one department known as the plastic department. R. E. Colman has been appointed manager of the new department, with an advisory committee consisting of Vice-President J. G. Barry, chairman; W. R. Burrows and C. E. Eveleth.

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Canadian General Electric Company has declared an extra dividend of $1 in addition to the regular quarterly of 87½ cents a share on the $50 common stock.

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Moloney Electric Company declared an extra dividend of $1 on the class A stock. A year ago a similar dividend was paid.

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Nashville Armature & Electrical Works, 616 Eighth Avenue, South Nashville, Tenn., has just been appointed exclusive distributor in the Nashville territory for the Howell "Red Band" motors.

•

Changes in personnel of the Pacific Coast offices of the Lincoln Electric Company, Cleveland, Ohio, include the appointments of S. H. Taylor, Jr., to succeed W. S. Stewart in charge of the coast headquarters at Los Angeles, Calif., L. P. Henderson as manager of the San Francisco office of this company, and E. J. Pfister, formerly of the Philadelphia and Allentown offices, as district manager of the Kansas City district. The Philadelphia office has been moved to the Commerce Building in that city, in charge of D. C. Anderson.

Important changes and improvements at the South Philadelphia, Pa., works of the Westinghouse Electric & Manufacturing Company, involving expenditures in excess of $300,000, have been announced from the office of the works management.

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Reduced Activity in Electrical Manufacturing

ACTIVITY in electrical manufacturing establishments in November underwent a further decline after the moderate falling off in October from summer levels. Consumption by establishments reporting each month to the ELECTRICAL WORLD constitutes the basis for the index numbers here presented.

After allowing for differences in the lengths of the working months November is 11.7 per cent below October, 17.2 per cent below September and 26.7 per cent below the preceding November. However, going back a little farther, the index stands higher than in most of the first eight months of 1928 and the larger part of 1927.

The upward movement began in September, 1928, culminating in the following June, and attaining an even higher peak in October, then declining moderately until September of the present year, and more sharply in October and November.

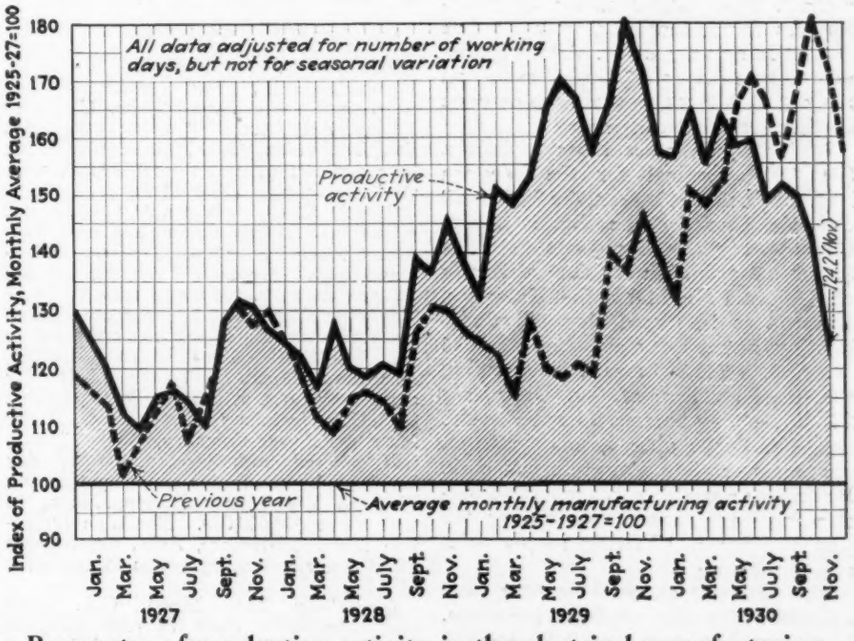
In the early months of the year 1930 figures were above those for 1929; the decrease in later months brought down the average, but for the entire eleven-month period it is only 5 per cent lower than last year.

While examination of individual returns discloses cases of plants running ahead of last year's November operations, there is in general a striking agreement in the way the returns for the two months compare, the energy consumption usually being between two-thirds and three-fourths as great this year as last.

Electrical manufacturing might have been expected to curtail activities toward the end of 1929, as other industries did. There was, in fact, some reduction in activity, but it was slight. The recent decline follows that in other industries at an interval of a whole year.

Comparative Index Numbers

November, 1930	124.2
October, 1930	140.6
September, 1930	150.0
August, 1930	152.2
November, 1929	169.5
October, 1929	180.6
First eleven months of 1930	152.1
First eleven months of 1929	160.1



Barometer of productive activity in the electrical manufacturing plants of the United States

Market Conditions

EW budget announcements indicate substantial power company business in New England early in 1931. Holiday slackness prevails in the equipment market in the Eastern district. Retail business in appliances, however, is more active than for many months. Appliance and radio sales on the Pacific Coast are shaping up well, but equipment business is small.

——BEYOND SEASONAL LINES LITTLE NEW BUSINESS is recorded in the South, although holiday trade is substantial.

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PACIFIC COAST

—THE FINAL WORD *on holiday buying is that the transactions were normal in number, but about 75 per cent of normal in value. Bargains were eagerly snatched up, but the principal demand covered waffle irons, reflector heaters, toasters, low-priced percolator sets, household mixers and small desk and kitchen electric clocks.*

—VERY FEW REORDERS *were placed by dealers. Radio business, on the contrary, veered more to the higher-priced sets.*

About $40,000,000 is to be spent in northern and central California for power company construction during 1931, of which about half covers miscellaneous distribution and transmission. Immediate expenditures cover a 34-mile, 60,000-volt distributing line in the Napa district, and $40,000 worth of transformers for Healdsburg, near by, this district being very active. Another early expenditure covers a $250,000 extension line out of Alturas, to cover the extreme northeastern part of the state.

Major construction items include a $4,000,000 terminal for the Western Pacific in Oakland harbor; the $5,000,000 dirigible base for the United States Government at Sunnyvale and a $1,000,000 extension for the University of California Hospital in San Francisco. Business to be placed shortly includes lighting fixtures for the Los Angeles Hospital, a $48,300 award for rewiring the naval air base at San Diego, six 24-in. revolving beacons for Los Angeles and San Diego airway, and floodlight equipment for San Francisco ball park. Machinery manufacturers report no outstanding equipment orders during the past two weeks. Wiring supply sales are holding up well.

Holidays and annual inventory have reduced sales to absolute minimum. Movement last week reported involving fifteen transformers from 10 kva. down, about $2,000 worth of miscellaneous switchgear to Puget Sound central stations and about 30 motors, including several 50-hp. machines to a pulp mill; the remainder, small sizes to dealers and to lumber mills for replacements. Bids opened December 22 for 40,000 lb. of copper wire by the city of Tacoma have been taken under advisement. Plans for the superstructure of the $500,000 Seattle city light power house at Diablo were approved by the Board of Public Works and contractors' bids will be invited early in 1931. Two generators and turbines, said to be the largest in the world, designed to double the capacity of the city light system, have been ordered. H. C. Moss Construction Company, Seattle, secured the contract for constructing the 30-mile transmission line from Aberdeen to Westport and Grayland, in Grays Harbor County, for the Twin Harbors Electric Company and will shortly purchase three 75-kva. transformers, poles, crossarms, hardware, insulators, wire, etc.

CONSTRUCTION PROJECTS

Southern Sierras Power Company, Riverside, Calif., plans construction of a transmission line from Blythe, Calif., to Parker, Ariz., about 40 miles; also, from San Bernardino, Calif., to Boulder Dam, both projects to cost over $400,000, with steel towers, etc. Oakland School District, Oakland, Calif., will build a vocational school unit in connection with new high school to cost $400,000. Modesto Irrigation District, Modesto, Calif., has applied for permission to use water from forks of Tuolumne River for a hydro-electric power project to develop 56,951 hp., estimated to cost $1,885,000. Ford Motor Company, Dearborn, Mich., will take bids for assembling plant at Seattle, Wash., to cost $2,500,000, including power plant. Rocky Mountain Power Company, Helena, Mont., will proceed with construction by day labor on hydro-electric power project on Flathead River, near Polson, Mont., to cost about $10,000,000. Randolph Irrigation District, Florence, Ariz., plans group of 34 electric pumping plants to cost over $600,000.

Meyenberg, Inc., Ripon, Cal., plans evaporated milk plant to cost $175,000. Los Angeles, Cal., will receive bids until December 31, for an ornamental lighting system.

SOUTHEAST

EXCEPT FOR SEASONAL LINES, *little activity is to be noted in the electrical field in the Southeast. Inquiries have slowed up as well as orders, and little business is anticipated until after the inventory period.*

One of the larger companies has within the past ten days ordered distribution transformers aggregating $20,300 and $10,100 in voltage regulators. Some orders from the Georgia territory were for $6,478 of insulators, $5,300 worth of bare and weatherproof copper wire and $3,760 of time switches in connection with off-peak water heater sales. A power company in North Carolina ordered four 100-kva. transformers. Another central station order was for $2,500 of "white-way" and street lighting materials. A North Georgia bleachery ordered looms and motors amounting to $92,000 and a mining concern in the Birmingham district ordered industrial motors costing $3,500. Bids are in this week on a 4,000-kw. turbine for installation in a textile mill in South Carolina.

CONSTRUCTION PROJECTS

Memphis Power & Light Company, Memphis, Tenn., plans steel tower transmission line over Mississippi River to point near Wyanoka, Ark., for connection with system of Arkansas Power & Light Company, to cost over $200,000. Franklin, N. C., plans ornamental street-lighting system. Aiken, S. C., has authorized plans for extensions and improvements in power plant to cost over $75,000. City Commission, Jacksonville, Fla., plans power substation to cost over $45,000, with equipment.

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Middle West

—SOME SLIGHT IMPROVEMENT *in general business in the Middle West section is noticeable this week. The volume of business increased a little and it is felt that the month will close better than anticipated at the beginning of December. The railroads are in the market for a considerable amount of rails and equipment, while the automotive industry is in a somewhat better position.*

Various utility companies are conservatively proceeding with as much construction work as possible, scheduling all necessary work as far ahead as it is practical to do so. There has been a slight increase in the demand for apparatus, while the demand for distribution equipment continues to hold up well. Some of the interesting items placed this week include 21 96-kva. automatic induction feeder voltage regulators, three 2,000-kva. oil-insulated, self-cooled, single-phase, 60-cycle transformers, 100 60-cycle, two-second

definite-minimum inverse time-limit overcurrent relays, three constructions of extensions to substation orders aggregating $70,000 and "Mazda" lamps valued at $150,000.

CONSTRUCTION PROJECTS

Kimberly-Clark Corporation, Neenah, Wis., plans addition to paper mill at Kimberly, Wis., to cost over $100,000. Commonwealth Edison Company, Chicago, Ill., will build three-story substation to cost about $100,000. United Electric Coal Companies, Inc., Danville, Ill., plans plant at coal-mining property at Duquoin, Ill., to cost $125,000. W. J. Holliday Company, Indianapolis, Ind., plans steel distributing and storage plant at Hammond, Ind., to cost about $100,000. Firestone Tire & Rubber Company, Akron, Ohio, has authorized construction of mill at Buenos Aires, Argentina, with electric power plant, to cost over $600,000. Ohio Edison Company, Youngstown, Ohio, has plans for a transmission line from generating plant at Toronto, Ohio, to East Akron, and vicinity, reported to cost over $250,000, with substation facilities. France Stone Company, Toledo, Ohio, plans expansion program at quarries at Bascom, Ohio, to cost about $80,000. Board of Education, Minneapolis, Minn., plans vocational school to cost $900,000. Sioux City Serum Company, Sioux City, Iowa, plans serum manufacturing plant to cost over $100,000.

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NEW ENGLAND

—MODERATE BUYING MARKS *the trend in this district, with orders for small motors steady and control equipment moving steadily. Interest in central-station supplies is heightened by encouraging announcements of new power apparatus to be used in this district.*

Substations are planned for southern and western Massachusetts, the latter to involve $1,000,000 for power development, including new installations of transformers, oil circuit breakers and control equipment. Further substation plans announce equipment will be required for a substation at Chelmsford, Mass., and the expenditure of over $100,000 in eastern Massachusetts. Street lighting is active and inquiries are being received in good volume. Recently traffic control costing about $59,000 was placed by the city of Boston. Large recreational grounds and a stadium with special lighting are planned for a prominent Massachusetts city.

CONSTRUCTION PROJECTS

Crocker, Burbank & Company, Fitchburg, Mass., will take bids for addition to power plant at paper mill to cost over $100,000. Cape & Vineyard Electric Company, Falmouth, Mass., plans addition to power plant at Vineyard Haven, to cost close to $70,000. Narragansett Electric Company, Providence, R. I., has filed plans for a power substation to cost $80,000; and will build extensions to transmission lines to cost over $100,000. Other projects include: New substation for Attleboro Electric Light Company totaling $111,300; new substation at Chelmsford, Mass., for Lowell Electric Light Company; and expenditure of about $1,000,000 by the Turners Falls Power & Electric Company for plant extensions.

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EASTERN

—THE HOLIDAY SEASON *is having its usual quieting effect on the electrical equipment market in the Eastern district, and in consequence, lessened sales are resulting. There is little to report in the line of new business for central station or industrial account; demand from both quarters shows a year-end inclination to defer anticipated purchases until next month.*

—RETAIL BUSINESS *has enjoyed its first real activity in practically a year; specialty sales, including holiday lighting apparatus, small appliances, electrical toys, etc., have reached a more satisfactory level, while electric refrigerators, vacuum cleaners and similar domestic products show volume business exceeding that of a year ago.*

With the turn of the New Year just at hand, equipment manufacturers are encouraged with the outlook for increased demand in the early months ahead, indicated by the 1931 construction programs now being arranged by central-station interests. The New England Power Association will expend an estimated appropriation of $12,000,000, of which about $3,000,000 will be used for the Narragansett Electric Company at Providence, R. I. The Philadelphia Electric Company is expected to adopt a budget of more than $15,000,000 for the coming year; the Tennessee Electric Power Company will expend $3,750,000 for expansion and betterments in the early months ahead; the Northern States Power Company will build an addition to its Riverside power station to advance the capacity by 46,800 hp., while two important steel tower transmission lines are projected in the Minnesota Valley district and the California-Oregon Power Company is arranging plans for a new hydro-electric generating plant of 53,300-hp. rating. Both of these last noted developments will represent a portion of a budget of $43,596,257 authorized by the Standard Gas & Electric Company for its different utility interests in 1931.

A manufacturer of stationary engines in Pennsylvania reports appreciably improved account, with orders booked during the last 60 days exceeding those for the same months of a year ago. Tacoma, Wash., is closing for about 40,000 lb. of copper wire for electrical service and is expected to place the order within a fortnight. The Edison Electric Illuminating Company, Boston, has secured a contract from the city for installation of an automatic traffic signal system on certain streets.

An electric company in New Jersey has placed an order for switching equipment with a New York manufacturer, totaling $100,000. A municipality in Missouri has contracted for equipment for a power plant to cost $123,600. A metropolitan power company has given a commitment for transformers and accessory apparatus to a New York maker, amounting to $35,000.

CONSTRUCTION PROJECTS

Board of Transportation, New York, has approved construction of subway repair and inspection shops to cost $1,000,000, with equipment. Curtiss-Wright Airports Corporation, New York, plans airport with aircraft assembling plant and seaplane base at Secaucus, N. J., to cost over $1,000,000. Atlantic City Electric Company, Atlantic City, N. J., plans transmission line from Brigantine Beach to Beach Haven, N. J., to cost $150,000. Department of Institutions and Agencies, Trenton, N. J., contemplates industrial school at Bordentown, N. J., to cost about $150,000. Gulf Refining Company, Pittsburgh, Pa., plans oil refining plant at Cleves, near Cincinnati, Ohio, to cost over $600,000. General Purchasing Officer, Panama Canal, Washington, D. C., is asking bids until January 19 for electrical equipment for towing locomotives (Panama Schedule 2619). Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will receive bids until January 6 for one motor-generator set for Mare Island Navy Yard (Schedule 4742).

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SOUTHWEST

—REPRESENTATIVES OF LARGE *manufacturers report no contracts of any consequence closed during the past week and a reduced number of small orders.*

There are some good-sized installations of machinery being estimated, but only emergency orders will be placed before the new year. Jobbers report a real Christmas rush for the last few days and one firm reports that it has in sight $75,000 worth of new business right after January 1.

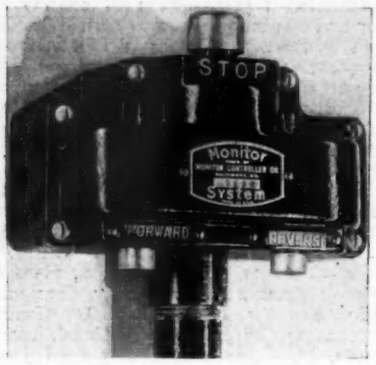
CONSTRUCTION PROJECTS

St. Louis Terminal Railroad Association, St. Louis, Mo., has authorized construction of a multi-story merchandise mart to cost $5,000,000. Missouri Utilities Company, Cape Girardeau, Mo., plans extensions and improvements in local street-lighting system to cost over $150,000. Board of Public Utilities, Kansas City, Kan., will take bids by close of month for addition to power plant to cost over $125,000. Walker-Craig Corporation, Brownsville, Tex., operating Olmito Canning Company, plans group of canning plants to cost over $500,000.

New Equipment Available

Push-Button Station for Machine Service

AN IRONCLAD PUSH-BUTTON master station, available for use in either a.c. or d.c. circuits, has recently been added to its line of control switches by the Monitor Controller Company, Baltimore. The station provides forward and reverse momentary contact control and is particularly suited to machine service.



A safety and convenience feature results from the arrangement of the buttons, the forward and reverse buttons being in a protected position at the bottom and the stop button on top, where it is protected and easy to operate. This arrangement is also adapted to give quick-action inching in either direction, the manufacturer states.

▼

Portable Equipment Makes Oil Tests in Field

OIL-TESTING SETS providing all the advantages of a laboratory, but of such size that they may be placed in any passenger car and taken into the field, are announced by the American Transformer Company, Newark, N. J. This equipment, designated "AmerTran" TS-6A, consists of a transformer, voltmeter, potentiometer, circuit breaker, oil cup, pilot light and power switch, and is designed to operate from a standard 110-volt, 50 to 60-cycle supply.

Foolproof construction and high accuracy are the two important features claimed for this test set. The oil to be tested is placed in a molded bakelite cup which is equipped with standard 1-in. disk electrodes set one-tenth of an inch apart. Then it is only necessary to close the power switch and rotate the potentiometer control until breakdown occurs, the potential being indicated by an accurate voltmeter.

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Inside Frosted Lamps in Sizes Up to 500 Watts

INSIDE-FROSTED LAMPS in sizes of 150, 200, 300 and 500 watts, for use in indirect and semi-indirect fixtures in stores, offices and homes where it is desirable to have soft, pleasing and comfortable illumination, are announced by the General Electric Company, Nela Park, Cleveland.

Inside-frosted lamps are said to contribute to the attractiveness of the interior by the elimination of striation-streaks of light on the ceiling—and the chain and hanger shadows common to open indirect or semi-indirect lighting fixtures equipped with clear lamps.

▼

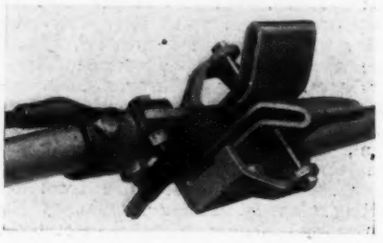
Cast-to-Size Connectors for Copper Tube Buses

A NEW CAST-TO-SIZE LINE of connectors for outdoor substation copper tube buses has been announced by the Delta Star Electric Company, Chicago, Ill. The clamping bolts in connection with the joint contact surfaces give a heavy

gripping action, to insure good contact. The connectors are cast in two halves, fully interchangeable, and can be carried in stock without keeping the connectors in pairs. They are made for all sizes of tubing.

Full-Floating, Self-Aligning Pressure Contact

A FULL-FLOATING, SELF-ALIGNING, self-releasing, medium pressure contact has been announced by the K-P-F Electric Company, San Francisco, Calif. It consists of a pair of clips which are held in position on the switch arm by means



of two adjustable toggle bolts. When the blade is inserted in the clips the tension on the toggle bolts is transferred to the blade and the clip adjusts itself exactly to the blade. When the blade is withdrawn and opened the clip follows, but due to the toggle action of the supporting bolts the clips are spread, thus relieving the pressure on the blade and it is easily opened, even when frozen with considerable sleet and ice. The blade is made long enough so that contact can be made at various points along it to allow for the sag of the line wires when in use.

▼

Oil Pump Unit Operates at Bottom of Well

A RECENTLY IMPROVED DESIGN of oil well pump can now be secured from the Arutunoff Engineering Company, Tulsa, Okla. The single unit of pump and drive motor operates at the bottom of the well. The unit is made in two outside diameters, $5\frac{3}{8}$ in. for motor sizes up to 75 hp. and $7\frac{1}{4}$ in. for sizes up to 200 hp.

The motors are 3,600 r.p.m., three phase, 60 cycle machines. As their diameters are fixed, motor lengths are relative to motor sizes. Motor voltages are 440 or other higher standard ratings, but on account of the drop in the feeder cable extending down into the well it is necessary to include an auto-transformer for voltage correction in practically every installation. Pumps are of centrifugal type with stages up to 100 or more. The various types are designed to work against heads of from 500 to 7,000 ft. and to deliver 500 to 10,000 bbl. per day.

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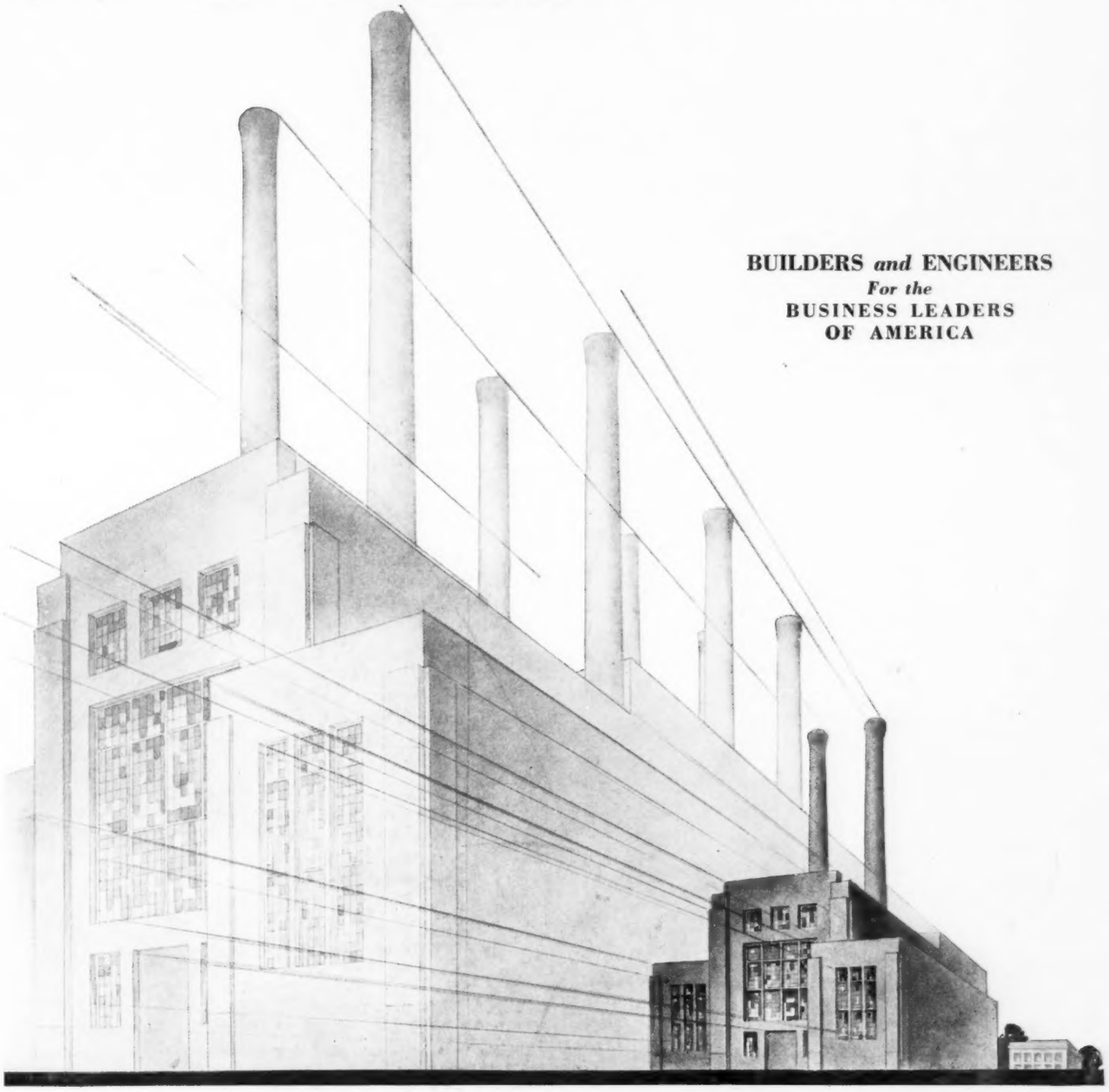

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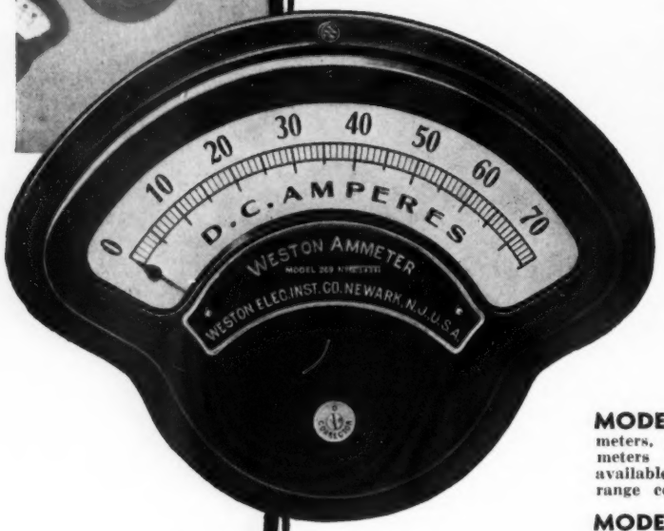
When it is necessary to mount several large instruments on a small panel without crowding or sacrificing the legibility of long scales, use Weston Fan Shapes.

These D.C. instruments are ideal for that purpose. Because of their fan-shaped case, the instruments may be staggered on the panel, one meter dovetailing with another; saving approximately one-third the panel area. Other advantages accruing from the unique fan shape are the unusually long scales and freedom from shadows.



Weston D.C. Fan Shapes are very attractive in appearance. Their compact construction and slight projection from the face of the switchboard are other features which help to overcome otherwise crowded appearance.

Weston D.C. Fan Shapes are made in four different models with scale lengths 2.5, 4, 6, and 7.6 inches in length, Models 267, 269, 271 and 273 respectively—all are of the Permanent Magnet Movable Coil Type, accurate within 1%, and shielded from external magnetic fields.

MODEL 267—D. C. Voltmeters, Ammeters, Millivoltmeters and Milliameters, available in a wide list of range combinations.

MODEL 269—D. C. Voltmeters, Millivoltmeters, Ammeters and Milliameters in a wide list of ranges.

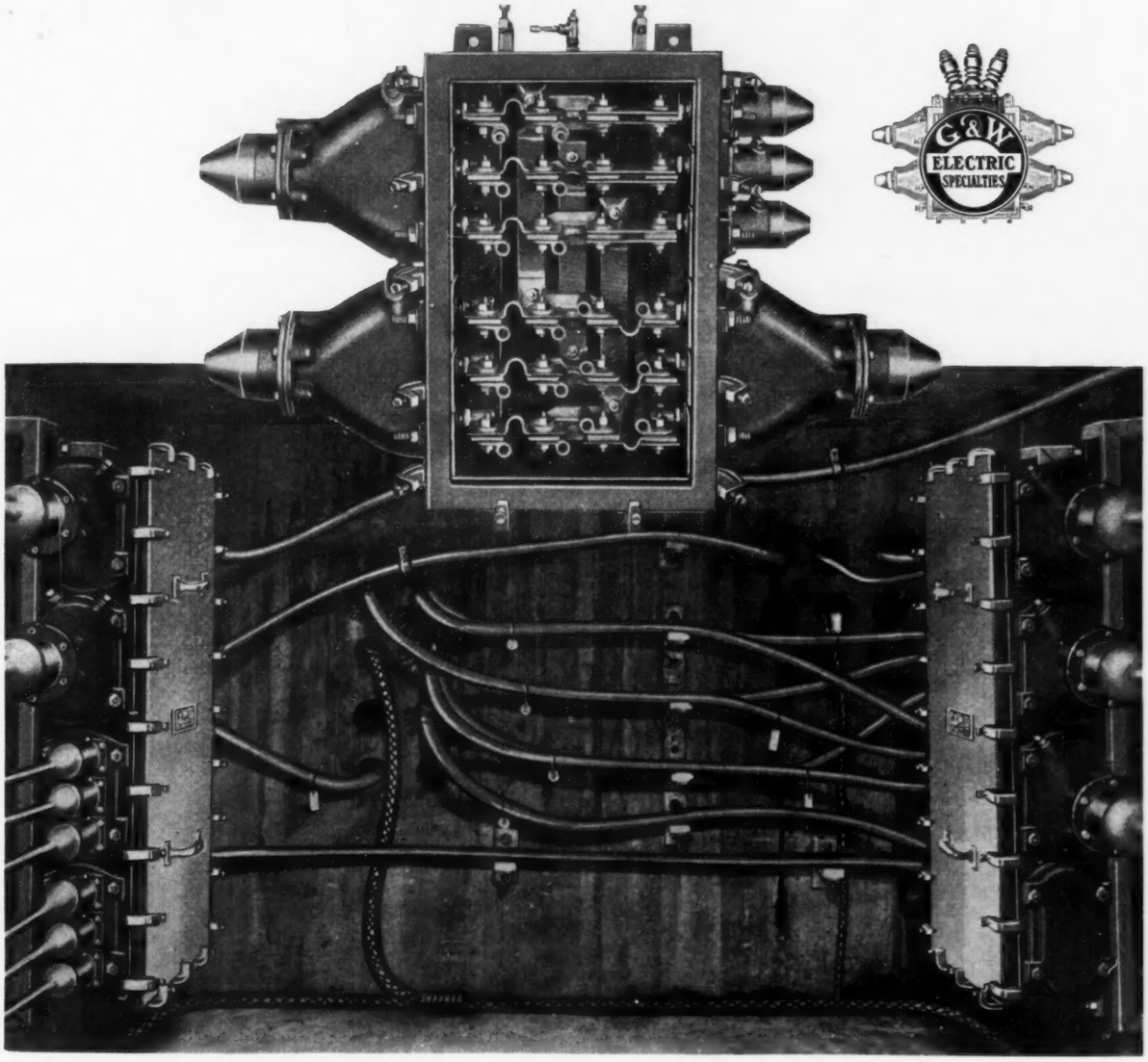
MODEL 271—D. C. Voltmeters, Millivoltmeters, and Ammeters in all standard ranges.

MODEL 273—D. C. Voltmeters, Millivoltmeters and Ammeters in wide list of ranges.

WESTON ELECTRICAL INSTRUMENT CORP.
578 Frelinghuysen Avenue, Newark, N. J.

Same contact fittings used for solid links or copper fuses

G & W Type "A" 600 Volt Box



Installation of Type "A," 8-Way, 3-Conductor, 600-Volt Box

Type "A" Boxes are assembled with standard parts to fit any requirement. Unit cable heads for single or multiple conductor cables are interchangeable.

SHEET METAL COVERS—COMPLETELY AIR TIGHT

See further box data in Bulletin "G."

Potheads • Subway Boxes • Cable Terminal Devices • Automatic Transfer Switches

G&W Electric Specialty Co.

7780 Dante Avenue, Chicago • • • • Representatives in Principal Cities

R&IE EQUIPMENT

for

Years to Come . . .

the *ECONOMIC INVESTMENT* R & I E EQUIPMENT is usually HIGHER in price . . . and ALWAYS cheaper to install and maintain . . . The character and scope of the service we can and do render is backed by 20 years' experience in serving producers and users of Electric Power.

RAILWAY AND INDUSTRIAL
ENGINEERING CO. . . . . GREENSBURG, PA.

Philadelphia
Pittsburgh
Buffalo
St. Louis

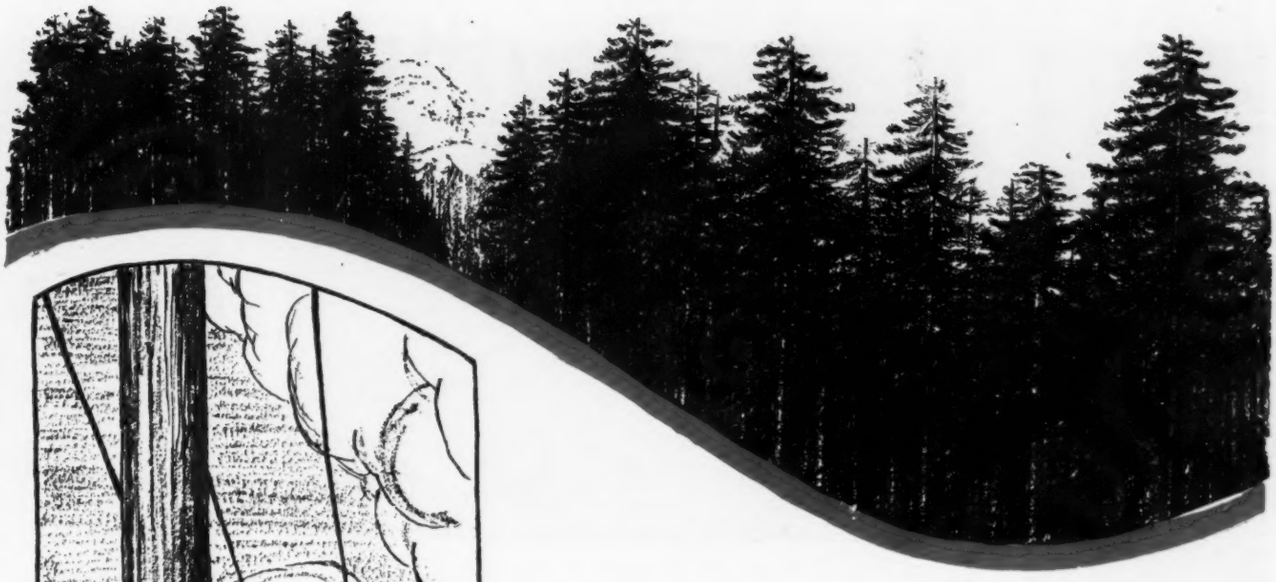
Boston
New York
Cleveland
Chicago
Cincinnati

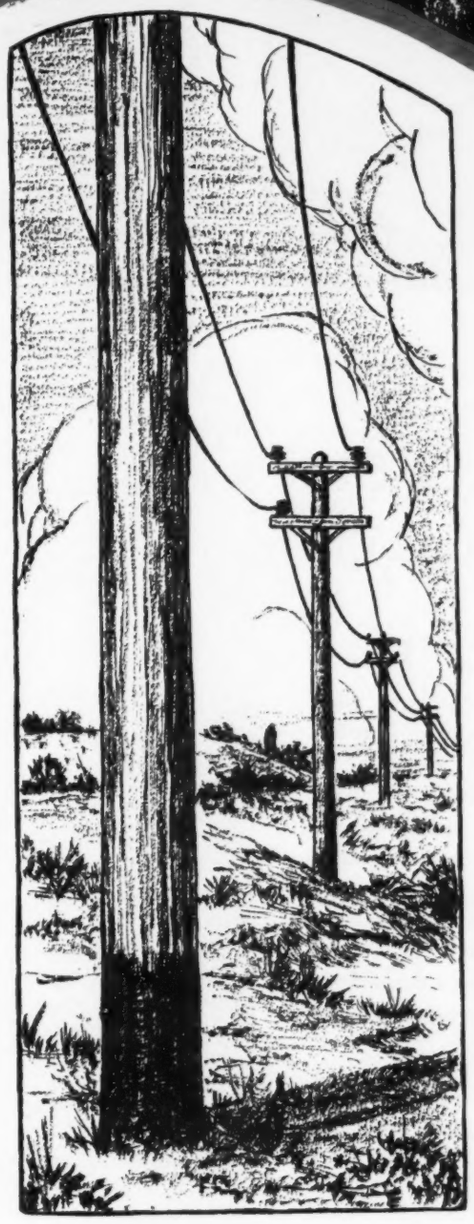
Denver
Dallas

Indianapolis
Kansas City
Charlotte
Birmingham
Los Angeles

Minneapolis
San Francisco
Seattle
Toronto

R&IE COST IS ALWAYS CONSISTENT WITH R&IE QUALITY





Firm anchorage

BUILT BY NATURE

Stability is an important requirement of a transmission pole.

With Western Red Cedar Poles, firm anchorage is the rule. The pronounced taper leaves it with an unusually large butt and a low center of gravity. Once fixed into the ground, it is there to stay.

In butt treatment, the creosote absorbed enhances this natural characteristic of the Western Red Cedar.

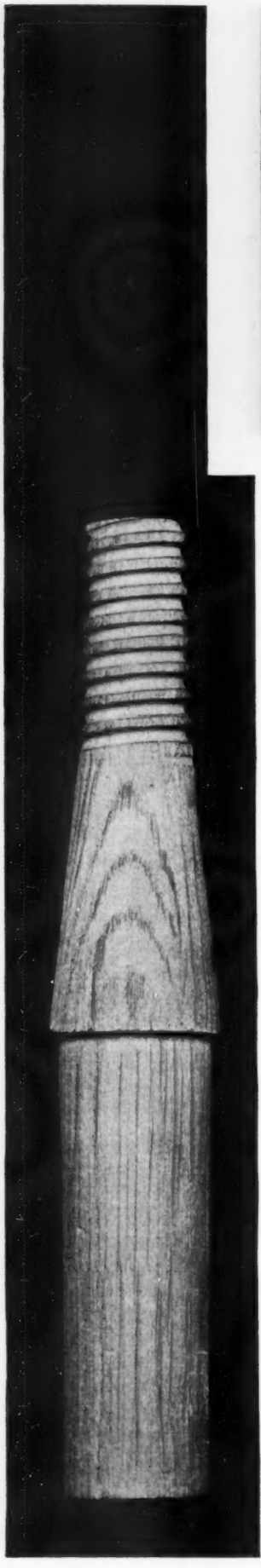
With strength to withstand the unusual stresses placed upon it, and stability to maintain its foothold in the ground, Western Red Cedar is the outstanding transmission line pole.

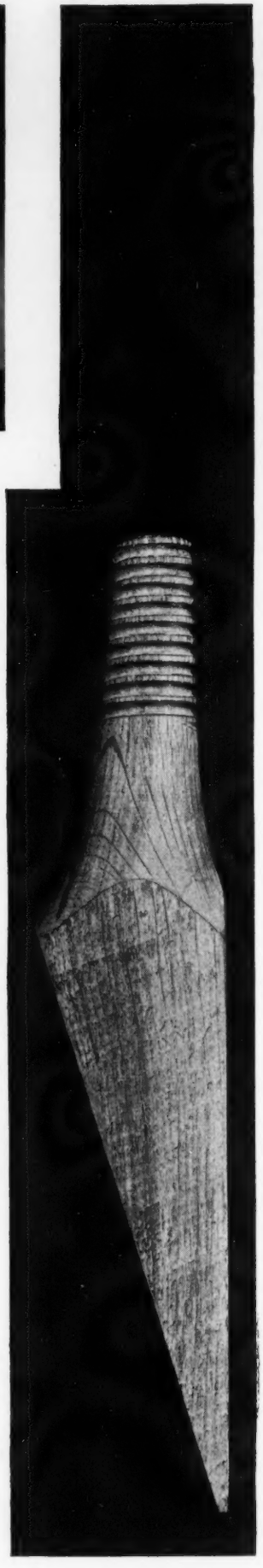
WESTERN RED CEDAR ASSOCIATION

Executive Offices, Spokane, Wash. *Research Division,* Minneapolis, Minn.

western red cedar poles

the choice of the utilities





LIGHTNING DAMAGE IS LESS FREQUENT ON *WOOD-PIN* INSULATED LINES . . .

Lightning probably will always cause trouble on high, medium and low tension transmission and distribution lines. However, the lightning risk can be materially lessened by mounting insulators on wood pins and wooden crossarms, thereby adding the insulation value of the wood to that of the insulator. Even in wet weather only a partial ground would result from insulator failure and the resistance to a lightning impulse is no less than with dry wood. In dry periods an insulator failure would cause little trouble because of safety factor provided by the wood.

Why locust pins rather than other kinds of wood? Because Locust pins are strong, they have long life and they resist decay in a remarkable degree.

All Locust pins are made in accordance with N.E.L.A. Specifications. Thoroughly seasoned and accurately turned. Will not shrink or warp.

We are prepared to ship in any quantity including carload lots on short order.

THE LOCUST PIN COMPANY

FRONT ROYAL, VIRGINIA

Grip is Vital *in a* "Wood Strain"

The self-tightening grip, a most important and exclusive feature of O-B Wood Strain Insulators, by the introduction of outer wedge plates and inner friction plates, provides a firm and lasting grip. It secures a uniform distribution of stress, thus developing the maximum strength of the wood, and prevents loosening of the grip in event of the commonly experienced weather shrinkage.

FREQUENTLY the commonly recognized high insulation values of wood poles and structures are largely dissipated by the use of uninsulated or under-insulated guys. The most practical method of preserving these high insulation values yet devised is that of using wood strain insulators.

However, any wood strain insulator which considers only the providing of adequate lightning flashover protection and under-rates the importance of long-sustained mechanical strength is of doubtful value, to say the least.

O-B Wood Strain Insulators have been designed and are manufactured with both of these worth-determining factors, high insulation value as well as long-sustained mechanical reliability, fully in mind. Laboratory tests demonstrate the former, a study of the O-B Grip design, the latter; while the outstanding performance of ten thousand O-B Wood Strain Insulators now in service offers important evidence of both.

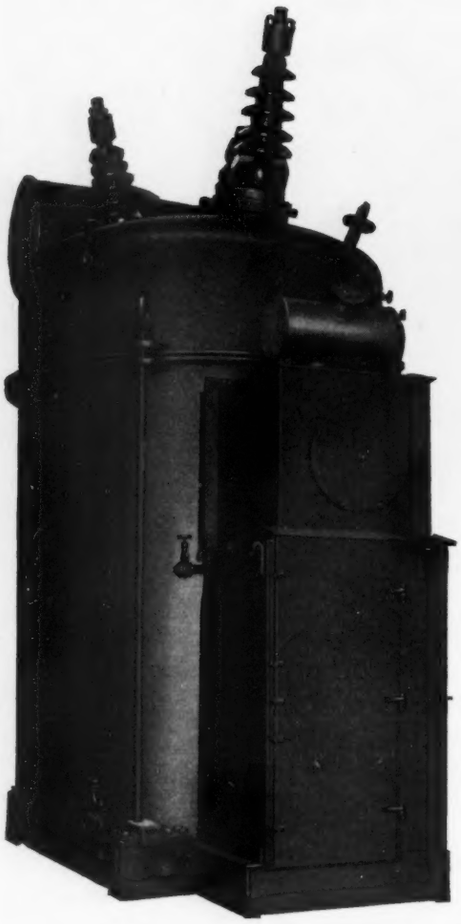
These design advantages which are highly important to the buyer of wood strain insulators, are fully discussed in Publication 404-H. If you do not have a copy address . . . . .

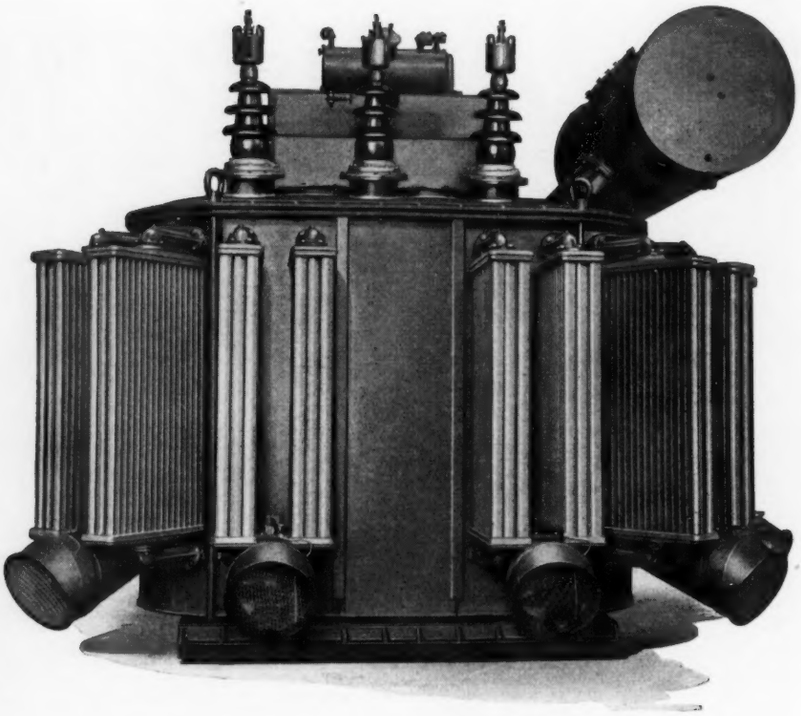
Ohio Brass Company, Mansfield, Ohio
Canadian Ohio Brass Co. Limited
Niagara Falls, Canada
1351H

Ohio Brass Co.

NEW YORK PITTSBURGH CHICAGO CLEVELAND ST. LOUIS ATLANTA DALLAS
PHILADELPHIA BOSTON LOS ANGELES SAN FRANCISCO SEATTLE

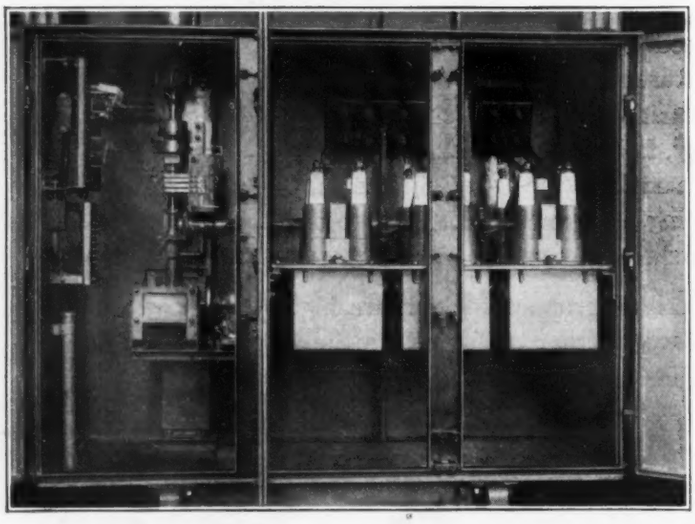
PORCELAIN INSULATORS
LINE MATERIALS
RAIL BONDS
CAR EQUIPMENT
MINING MATERIALS
VALVES





Transformers

—— to meet every Power Distribution Problem



ALLIS-CHALMERS TRANSFORMERS with forced air cooling offer a solution to the problem of handling peak loads without having a surplus of transformer equipment on the lines at off peak times.

Tap changers are built, for operation under load, to regulate the voltage or the phase angle of the power circuit. They are suitable for either single phase or three phase operation.

Pot head construction can be provided for both high and low voltage terminals eliminating danger of accidental contact or of operation in dusty locations. Disconnecting and grounding switches can be provided.

In addition to power transformers of any capacity, voltage or service, Allis-Chalmers also builds distribution, furnace, and special transformers.

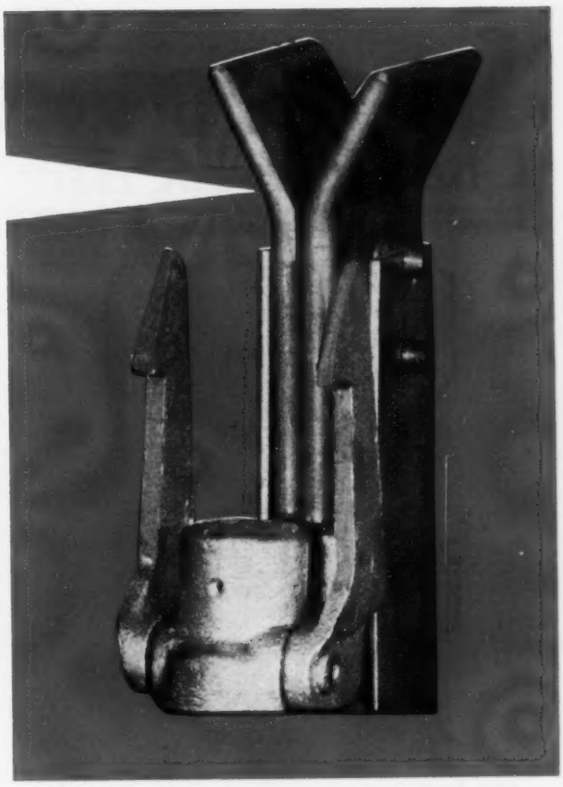
ALLIS-CHALMERS

—— Allis-Chalmers Manufacturing Company, Milwaukee ——

Rite-Pressure Contacts

Proper Areas and Pressures Properly Applied

« »



Rite-pressure contacts on Delta-Star Switches have *sufficient* pressure to wipe clean at each operation, but *insufficient* pressure to cut or wear away their surfaces. Also they compensate for misalignment, always giving *full contact.*

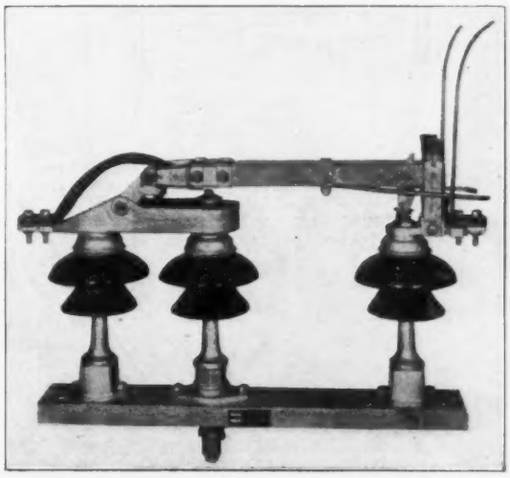
JUST as no chain can be stronger than its weakest link, no switch can be more conductive than its contacts. The well proportioned and balanced design of Delta-Star Switches makes their contacts the chain's strongest link.

¶ They insure certain opening and closing under most adverse conditions. The operating mechanism parts cannot slip and get out of adjustment.

¶ When the switch is open, the floating contacts close against one another so tightly that dust, dirt, soot and ice are excluded. Clean metal meets clean metal over adequate area when the switch closes.

¶ All parts are fully standardized—insuring quick shipment, easy installation and low maintenance.

¶ Have you a copy of Bulletin 39-A? If not, may we send you a copy?



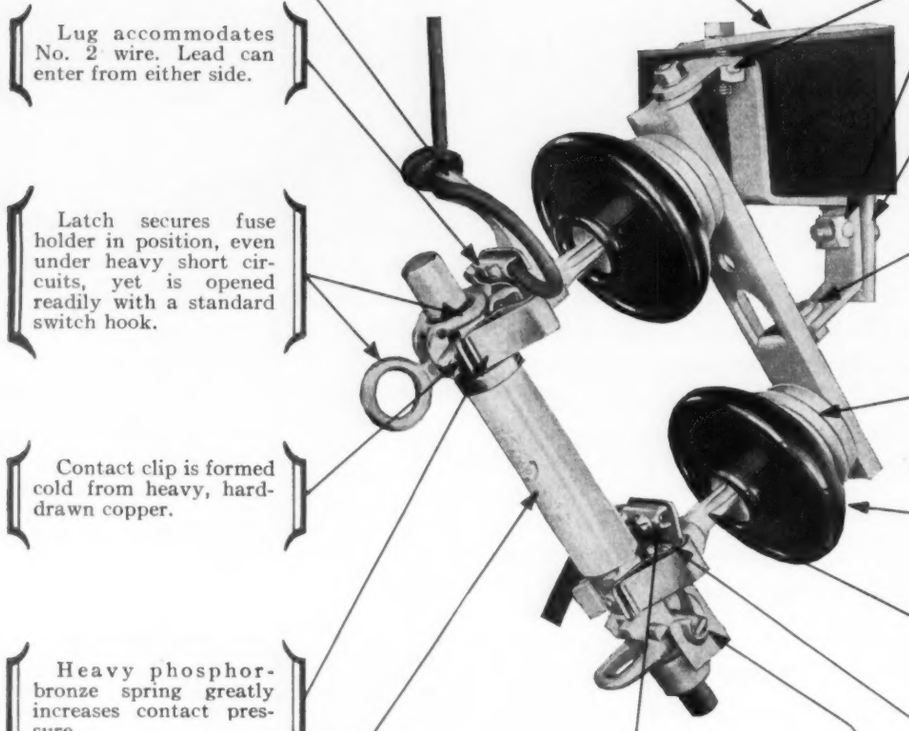
A single pole unit of a Delta-Star "MA-39" 15 K.V. 400 ampere gang operated pole-top switch with Rite-pressure contacts.

DELTA-STAR ELECTRIC CO.

CHICAGO, ILLINOIS

2400 BLOCK, FULTON STREET

Improved Mechanical
Characterize These New Open-type Cutouts



Eye-shaped lead support removes strain from lead and terminal lug. No tie insulator is required on the lower cross arm.

Hanger can easily be clamped to any cross arm.

All steel parts are hot-dip galvanized. Contacts and terminals are nickel-plated.

Nuts are welded to the hanger.

Lug accommodates No. 2 wire. Lead can enter from either side.

Only one bolt need be removed to install or remove the cutout.

Swivel mounting to cross-arm clamps allows three positions. Cutout can be turned thirty degrees either side of center.

Latch secures fuse holder in position, even under heavy short circuits, yet is opened readily with a standard switch hook.

Pressed-steel cap cemented to porcelain and having two bolts for attaching to the hanger.

Contact clip is formed cold from heavy, hard-drawn copper.

Wet-process porcelain insulator, easily replaceable.

Forged-steel pin cemented inside the porcelain.

Heavy phosphor-bronze spring greatly increases contact pressure.

Two bolts secure the contact to the pin.

U-shaped terminal lug riveted to extension of contact clip. Two screws clamp lead directly against the clip, thereby minimizing the number of current-transfer points.

Position of fuse holder, thirty degrees from vertical, makes it more accessible.

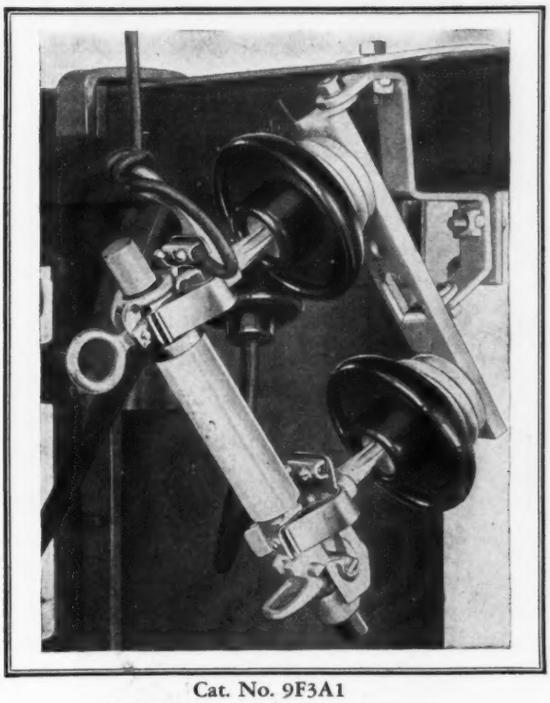
Fuse holder hinged in heavy pressed-steel bracket, which is bolted to insulator pin.

JOIN US IN THE GENERAL ELECTRIC PROGRAM, BROADCAST EVERY SATURDAY EVENING ON A NATION-WIDE N.B.C. NETWORK

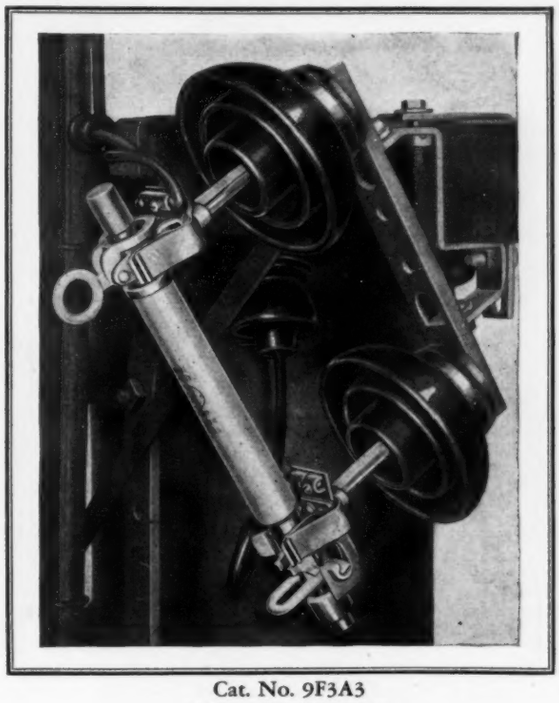
GENERAL

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.

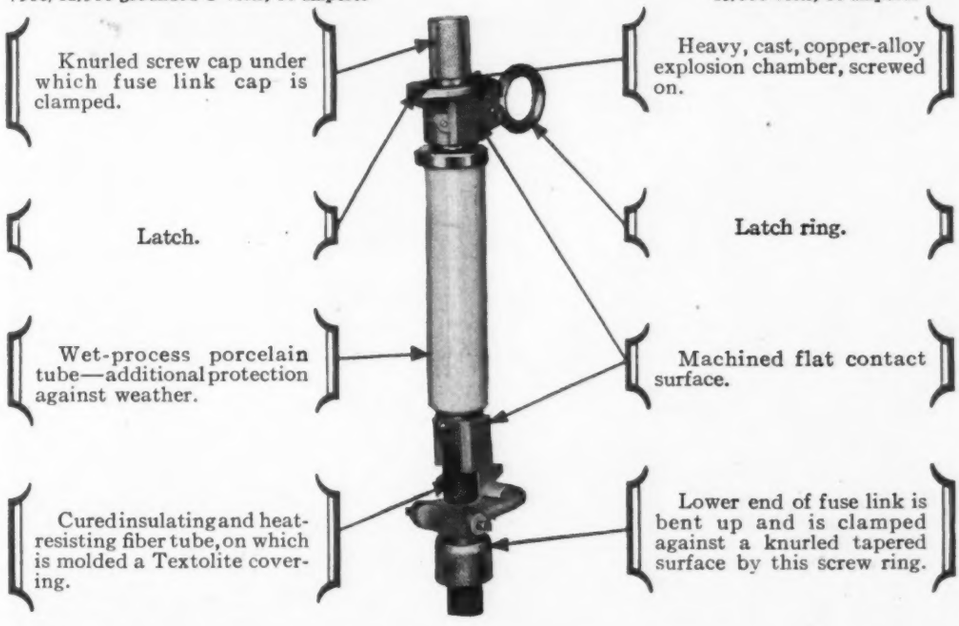
and Operating Features for Rural Distribution Systems



Cat. No. 9F3A1
7500/12,500 grounded Y volts, 60 amperes



Cat. No. 9F3A3
15,000 volts, 60 amperes


Knurled screw cap under which fuse link cap is clamped.
Latch.
Wet-process porcelain tube—additional protection against weather.
Cured insulating and heat-resisting fiber tube, on which is molded a Textolite covering.
Heavy, cast, copper-alloy explosion chamber, screwed on.
Latch ring.
Machined flat contact surface.
Lower end of fuse link is bent up and is clamped against a knurled tapered surface by this screw ring.

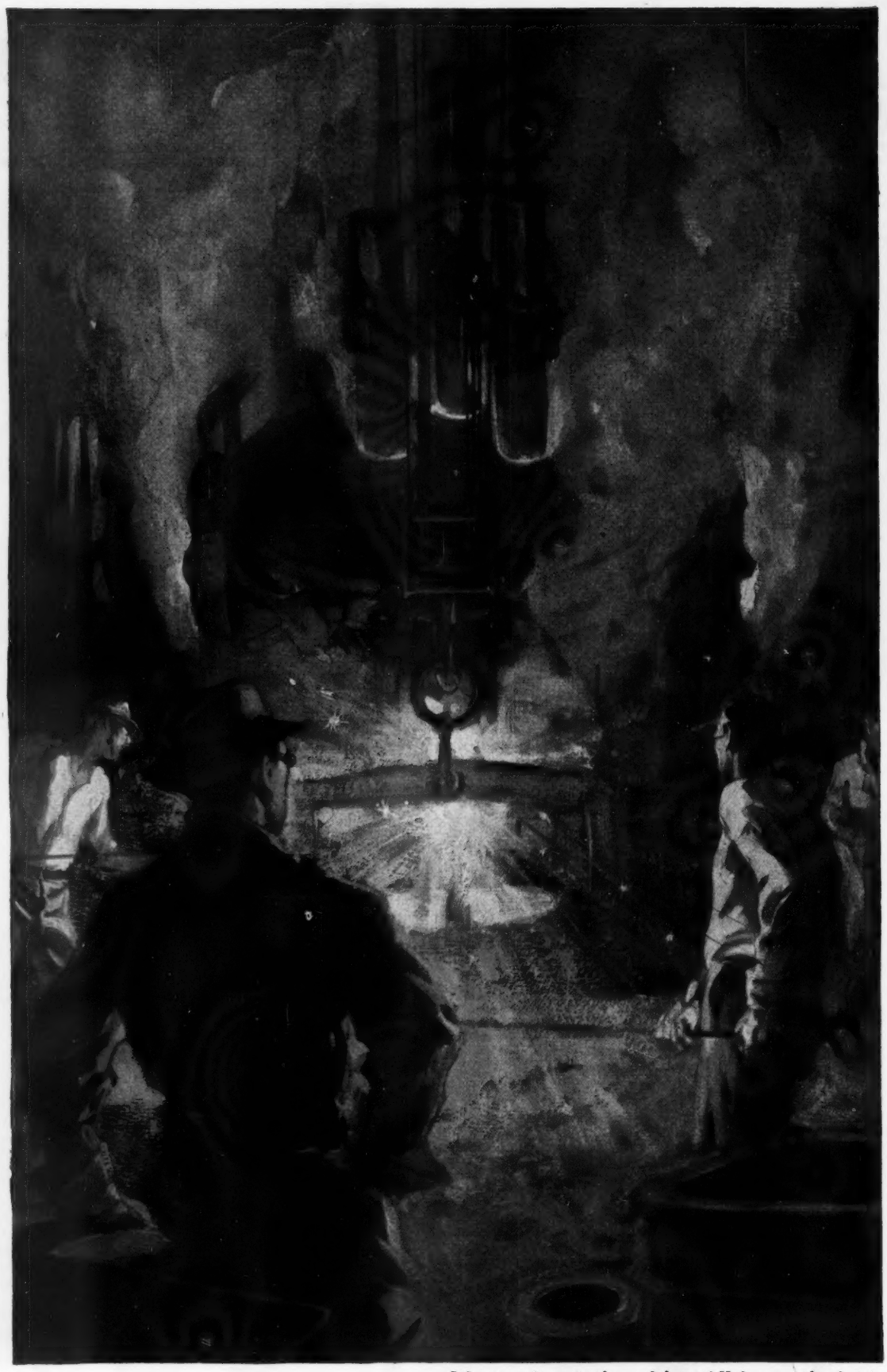
Design of Fuse Holder Is Such that Fuses Can Be Renewed Easily in the Dark and without Use of Tools

Complete description in Bulletin GEA-1328, which will be sent, on request, by your G-E local office.

420-34

ELECTRIC

SALES AND ENGINEERING SERVICE IN PRINCIPAL CITIES



Like giant forges in the workshops of Vulcan are the electric furnaces in Crane foundries. From them comes steel as truly tempered to its ultimate purpose, more scientifically tested for dependability, than the Damascus steel in swords of old.

The oven... the cook... and the cake

"Only fine ovens produce cakes of fine texture." This rule applies as surely to the most complicated "cake-baking" process in modern industry . . . making steel castings for high pressures . . . as it does to the simplest domestic cookery.

In basic-lined Heroult electric furnaces that apply the heat directly and cleanly to the metal and permit exact control of temperatures at every stage, the steel for Crane cast steel valves and fittings is prepared.

Every casting is annealed . . . though some specifications do not require it . . . under temperatures held at 1600° F for hours, then slowly shaded off to cooling.

Interesting as is the Vulcan-like foundry equipment in Crane foundries, complete as are the manufacturing resources that give exactness and uniformity in production, the vital secret back of quality in Crane electric steel materials is not the "oven" but the skill of the "cooks" . . . the chemists, the superintendents, the workmen who watch and control each step and process.

Through 75 years this skill has been developed and refined. Back of it is an exhaustive scientific library of laboratory studies and test charts. Against this long experience and collected knowledge, each day's run is checked and double-checked.

The result: cast steel materials for pressures from 150 pounds at 750° F to 1500 pounds at 750° F . . . and special materials for ratings even higher . . . about whose uniform dependability there is no question.

To help you select from these materials the right ones for your needs, and to give you the full benefit of Crane experience with valves, specialists in piping materials and their layout are maintained at strategic points throughout the country. Call on them.

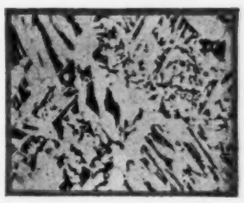
CRANE

PIPING MATERIALS TO CONVEY AND CONTROL STEAM, LIQUIDS, OIL, GAS, CHEMICALS

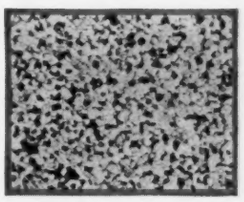
GENERAL OFFICES: 836 S. MICHIGAN AVE., CHICAGO
NEW YORK OFFICES: 23 W. 44TH STREET

Branches and Sales Offices in One Hundred and Ninety-six Cities

1855
SEVENTY-FIFTH
ANNIVERSARY
1930



Before annealing, coarse slivers of steel are seen in cast steel under the microscope.



This square of Crane cast steel, after annealing, shows how the slivers have been broken up into fine even grains, eliminating all internal strains and giving the strength and ductility necessary under high temperature conditions.

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Atlanta, Georgia
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405 Bona Allen Bldg.

Baltimore, Md.
Industrial Power Equip. Co.
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Boston, Mass.
Geo. H. Wahn Co.
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280 Carolina St.

Chicago, Ill.
John R. Smith
844 Rush St.

Cincinnati, Ohio
S. L. Currier
833 Union Trust Bldg.

Cleveland, Ohio
Public Service Supply Co.
627 Union Trust Bldg.

Kuhlman transformers are popular in our very best circles

Dallas, Texas
F. T. Morrissey & Co.
1408 Allen Bldg.

Denver, Colo.
Joy & Cox, Inc.
314 Tramway Bldg.

Detroit, Michigan
Richard P. Johnson
10-230 General Motors Bldg.

Indianapolis, Ind.
Scott Jacqua Co., Inc.
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Wm. H. Fernholz
1031 Clybourn St.

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C. F. Henderson
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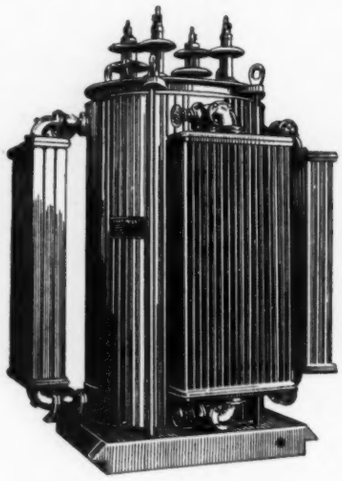
Toledo, Ohio
Howard J. Wittman
319 Spitzer Bldg.

York, Pa.
Harry W. Motter
25 N. Duke St.



WAY up in three hour lunch society, and out where the hot dog is the piece de resistance . . . there you'll find Kuhlman Transformers popular.

Engineers everywhere—whether two fisted or manicured—white collared or muddy booted—all like Kuhlman Transformers.

Democratic—good mixers—that's Kuhlmans all over. They're ready to give good account of themselves anywhere, from the humblest position to the biggest job in the ritziest substation.

Popularity hasn't spoiled them either. They're better than ever—get better and better year by year.

Every time we can find a way to improve them, we do it.

KUHLMAN ELECTRIC CO., Bay City, Mich.

KUHLMAN TRANSFORMERS

LONG LIFE LOW LOSSES

L-M FUSES

for DEPENDABLE SERVICE

Made of the best wet process porcelain « Bakelite doors « liberal contact surfaces « essentials of permanency and dependable service. Available from 2300 Volts to 12,500 Volts, up to and including 150 Amperes.

LINE MATERIAL Co

Main plant, S. Milwaukee, Wis., Branch plants, E. Stroudsburg, Pa., Barton, Wis., Gary, Ind., Scarboro Jct., Ont., Canada

For Greater Protection Use L-M FUSES

AVOID THAT KICK

USE HUBBARD HARDWARE

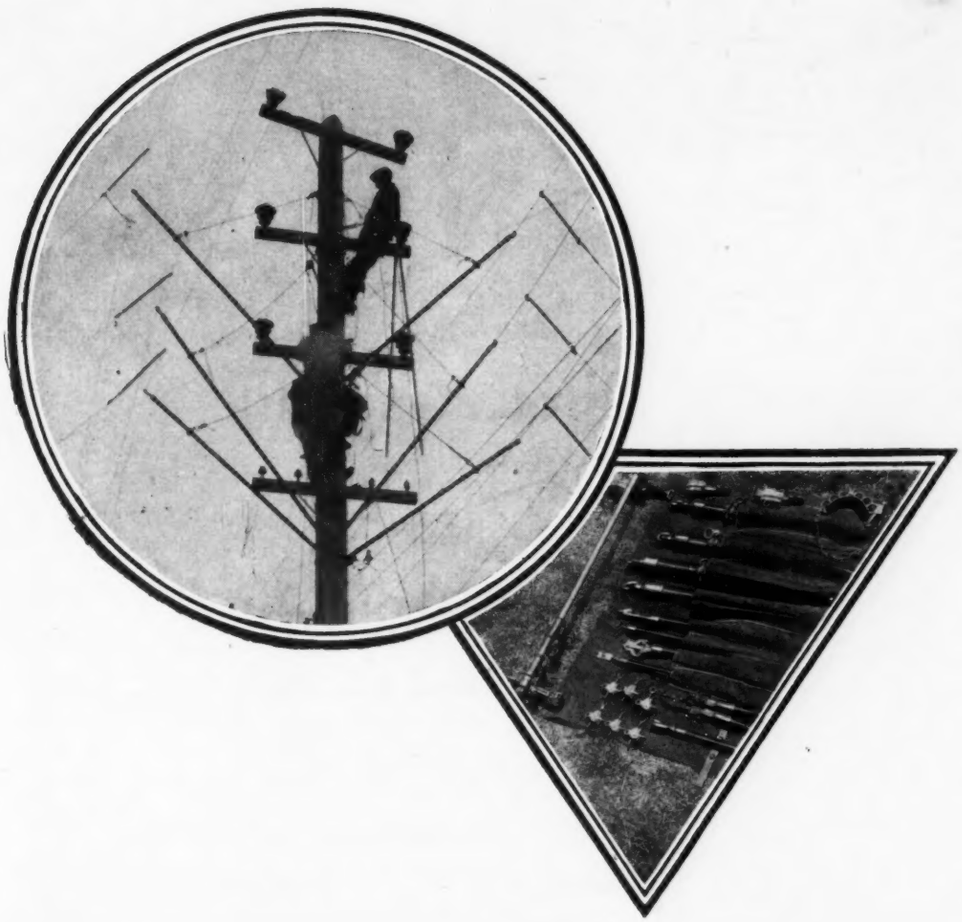
When Mrs. O'Leary was engaged with her daily chores one day back in October, 1871, she little realized that she was to be the indirect cause of making 100,000 people homeless, cause of the death of 250 persons and a loss of $196,000,000 in property, all directly resulting from a lantern that was kicked by a cow.

Appalling consequences often result from insignificant beginnings. Costly damage suits may arise from slight accidents such as a pedestrian striking an unprotected guy wire in the dark. It pays to play safe. Eliminate that chance of loss by using Hubbard Guy Wire Protectors on every guy.

HUBBARD

Hubbard and COMPANY

PITTSBURGH · OAKLAND, CAL. · CHICAGO



Eliminate Line Outages with Kearney Live Line Tools

WITH the enormous increase in consumption of kilowatt hours during the past few years, the importance of continuous service has been greatly emphasized. Line outages will not only decrease revenue but will also effect an item of much greater importance, namely, the customer's good-will. Kearney Live Line Tools make it possible to do 90% of the maintenance work required on all transmission and distribution lines without the slightest interruption of service. In many cases, live line maintenance will show an actual saving over the cost of working dead lines.

OTHER KEARNEY PRODUCTS

Steel Rod, Pipe Rod, "No-Rench" Screw Anchors and Hi-Tension 4-in-1 Expansion Anchors, all made of certified malleable iron; Two-Insulator Fuse Switches; Double Duty Cutouts; Sleeve Twisters with Interchangeable Dies; Guy Wire Clips; Connectors.

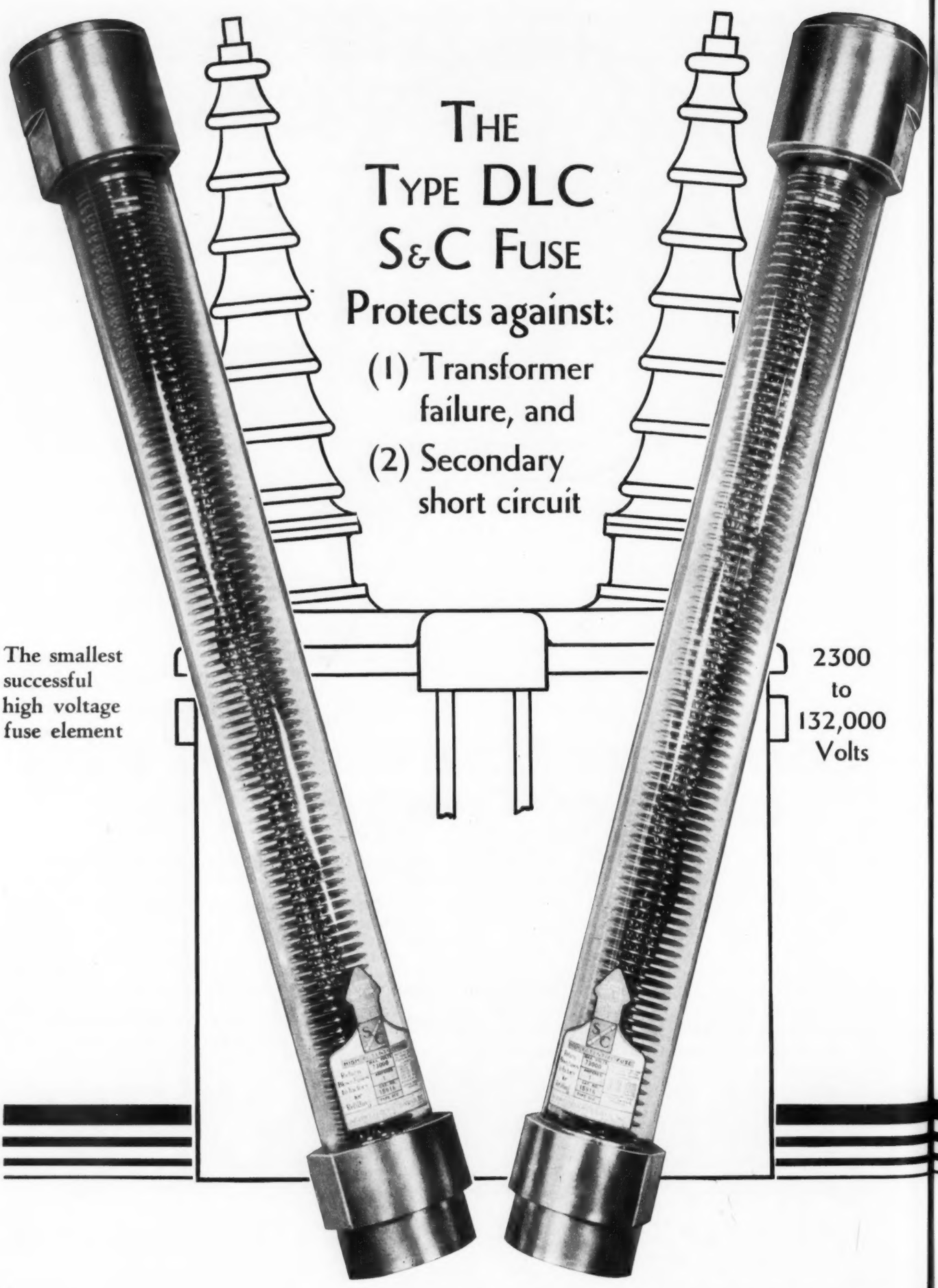
JAMES R. KEARNEY CORPORATION

4220-44 CLAYTON AVE., ST. LOUIS, MO.

Factories: St. Louis, Mo. ' ' ' Taylorville, Ill. ' ' ' Toronto, Canada

KEARNEY

THE ELECTRICAL INDUSTRY'S PRODUCTS


THE
TYPE DLC
S&C FUSE
Protects against:
(1) Transformer failure, and
(2) Secondary short circuit
The smallest successful high voltage fuse element
2300 to 132,000 Volts

THE RIGHT FUSE

for Potential Transformer Application

The Type DLC, S&C Fuse not only offers protection to the electric power system through rapid isolation of the potential transformer in case of primary insulation failure, but, in addition, gives protection to the transformer in case of secondary short circuit.

The Type DLC has the high current-interrupting capacity and dependability which characterizes S&C Fuses as a whole. Also, it blows at such low current values that the potential transformer is protected against secondary short circuits, near the secondary terminals, without the necessity of secondary fuses.

This double protection is an important feature of the Type DLC, S&C Fuse because it very frequently prevents the loss of a potential transformer, by disconnecting it before enough heat results from a secondary short circuit to break down the transformer insulation.

Ask for Bulletins 200-B and 200-R giving valuable information on potential transformer protection.

SCHWEITZER AND CONRAD, INC.

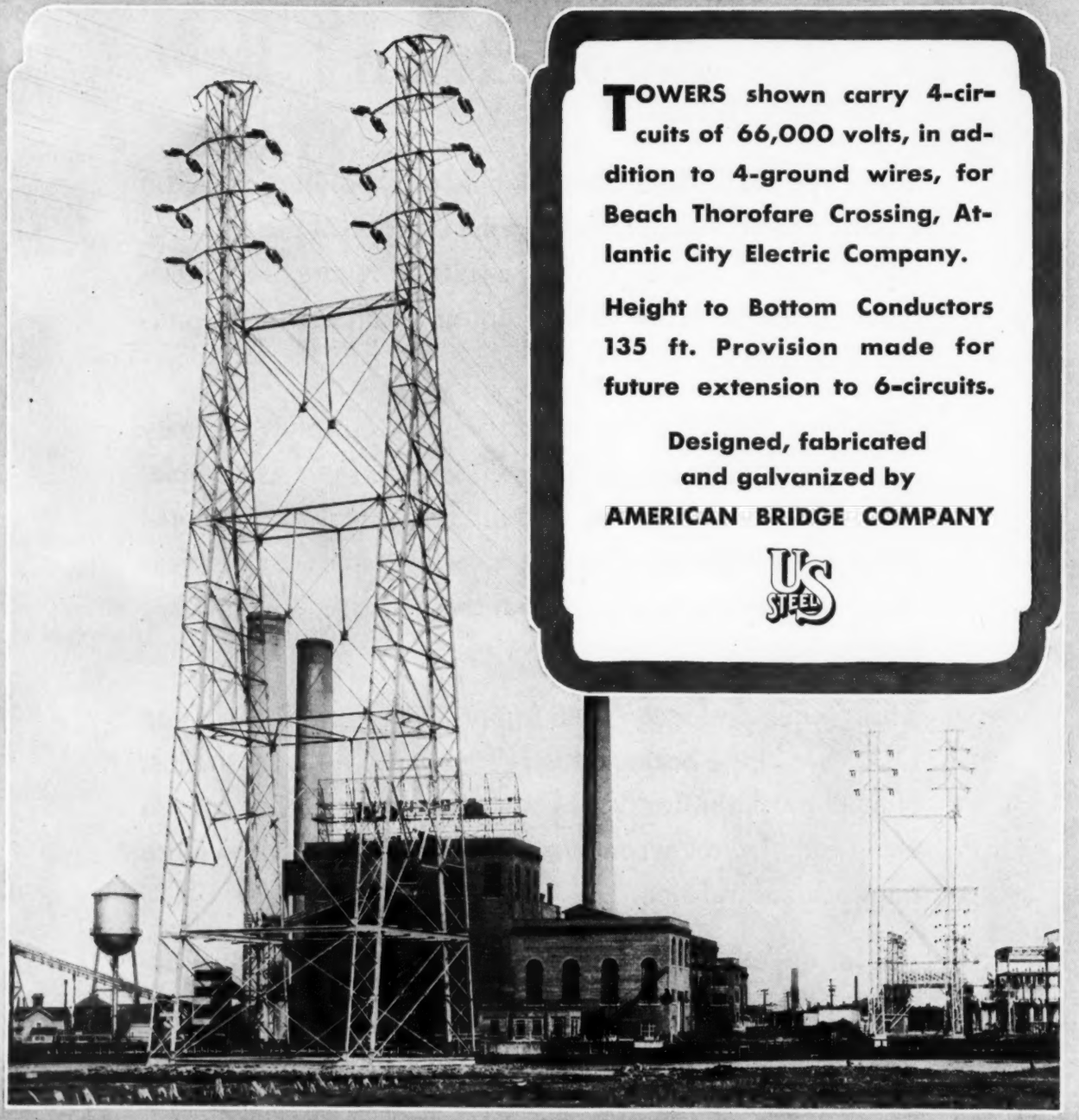
4435 RAVENSWOOD AVENUE — CHICAGO, ILLINOIS, U.S.A.

Boston, New York, Philadelphia, Buffalo, Pittsburgh, Cleveland, Duluth, Detroit, Birmingham, St. Louis, Kansas City, Omaha, Denver, Dallas, Salt Lake City, Seattle, San Francisco, Los Angeles

Trade Mark Reg. U. S. Pat. Off.

Japan, T. Hasegawa Co., Osaka

ABCo TRANSMISSION TOWERS



TOWERS shown carry 4-circuits of 66,000 volts, in addition to 4-ground wires, for Beach Thorofare Crossing, Atlantic City Electric Company.

Height to Bottom Conductors 135 ft. Provision made for future extension to 6-circuits.

Designed, fabricated and galvanized by
AMERICAN BRIDGE COMPANY

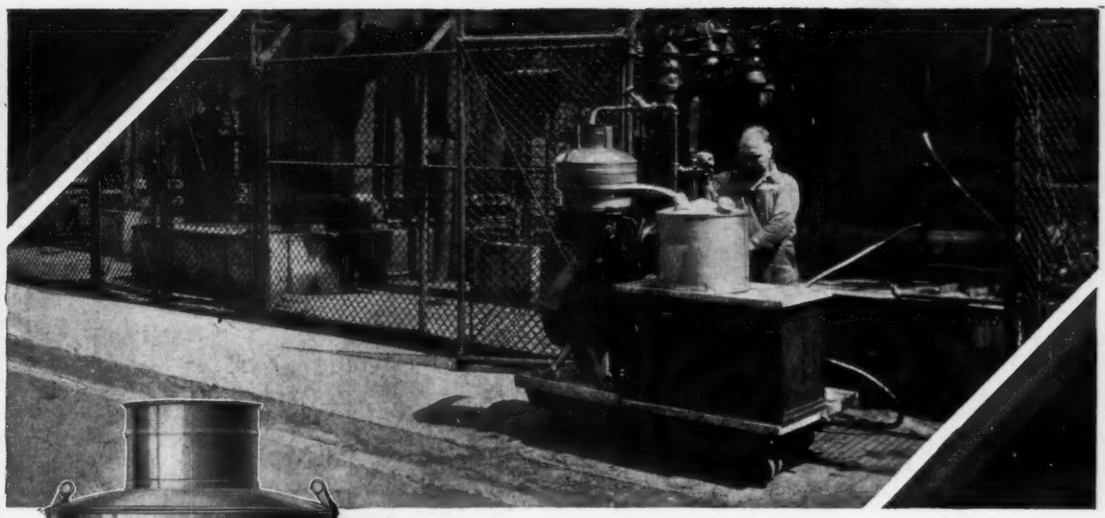
US STEEL

AMERICAN BRIDGE COMPANY

Subsidiary of United States Steel Corporation

General Offices - 71 Broadway, New York City

Tower Department, Frick Building, Pittsburgh, Pa.



The upper illustration shows a portable De Laval Insulating Oil Purifier used by Public Service Electric & Gas Co., of New Jersey. Stationary De Lavals, pipe connected to transformers and oil circuit breakers, are also used by this company.

UNUSUAL ECONOMY

THE use of a De Laval Insulating Oil Purifier is one form of economy which leaves no regret.

It reduces the total time required for insulating oil maintenance — yet enables transformers and oil circuit breakers to have better protection; requires less skilled attention — yet produces uniformly better results; costs less per hour of operation — yet does more work.

Although these are big claims, every one of them is proved by the many hundreds of De Laval Insulating Oil Purifiers which are maintaining the dielectric strength of insulating oil throughout the world.

— And the greater ultimate economy of De Laval Purifiers is proved by the fact that they are used by 95% of America's greatest electric power systems.

Bulletin 107-W is yours for the asking.

THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 600 Jackson Blvd., Chicago

DE LAVAL PACIFIC COMPANY, 61 Beale Street, San Francisco
THE DE LAVAL CO., Ltd., Peterborough and Winnipeg, Canada
ALFA-LAVAL CO., Ltd., 34 Grosvenor Road, London, S. W. 1.

DE LAVAL OIL PURIFIER

Types for Lubricating and Insulating Oil
Stationary and Portable Equipment

ANACONDA
from mine to consumer
REG.U.S. PAT.OFF.

The Name

ANACONDA

means one manufacturer

with 12 modern plants from the Atlantic to the Pacific...

ANACONDA WIRE

General Offices: 25 Broadway, New York

Sales Offices in

and 65 DIFFERENT PRODUCTS -

How many can you name?

COPPER RODS
BARE WIRE
- Brass
- Bronze
- Solid Copper
- Heavy Stranded
- Fine Stranded
- Fine Bunched
- Round Braided
- Flat Braided
- Trolley Wire
- Bus Bar
- Large Rectangular
- Small Rectangular
- Tinned Wire
- Hitenso
- Rail Bonds
- Hollow Conductor
- I-Beam Core
- Composite Cables
- Antenna

POWER CABLE
- Paper, Lead, Type H
- Varnished Cambric, Braid, Varnished Cambric Lead
- Varnished Cambric Parkway
- Varnished Cambric No-Steel Parkway
- Rubber and Steel Parkway
- Rubber Non-Metallic Parkway
- Duraseal—Non-Metallic Distribution Cable

WEATHERPROOF WIRE
SLOW BURNING WIRE
MAGNET WIRE
- Cotton
- Silk
- Rectangular
- Square
- Paper
- Enamel
- Special

RUBBER COVERED WIRE
- Braided
- Flexible, Extra Flexible
- Fixture Wire
- Mining Machine Cable
- Copper Telephone Wire
- Hitenso Telephone Wire
- Bronze Telephone Wire
- Signal Wire
- Control Cable
- Durax Sheathed Cable
- Tree Wire (Duracord)
- Lead Covered
- No-Steel Parkway
- All Parkway
- A B C Armored Cable
- Non-Metallic Underground
- Corona Proof

CORDS
- Flexible
- Heater
- Radio Wire
- Duracord
- Security Flexible

AUTOMOBILE WIRE
- Lighting Wire
- Starter Cable
- Ignition Wire

ANNUNCIATOR AND OFFICE WIRE
CONDUIT
- Duraduct Loom
- Automobile Loom
- Duratube
- Flexible Metallic
- Miscellaneous Loom Products

THERMOSTAT WIRE
OVERHEAD LINE HARDWARE
- Seamless Copper Connectors
- Dead-End Fittings

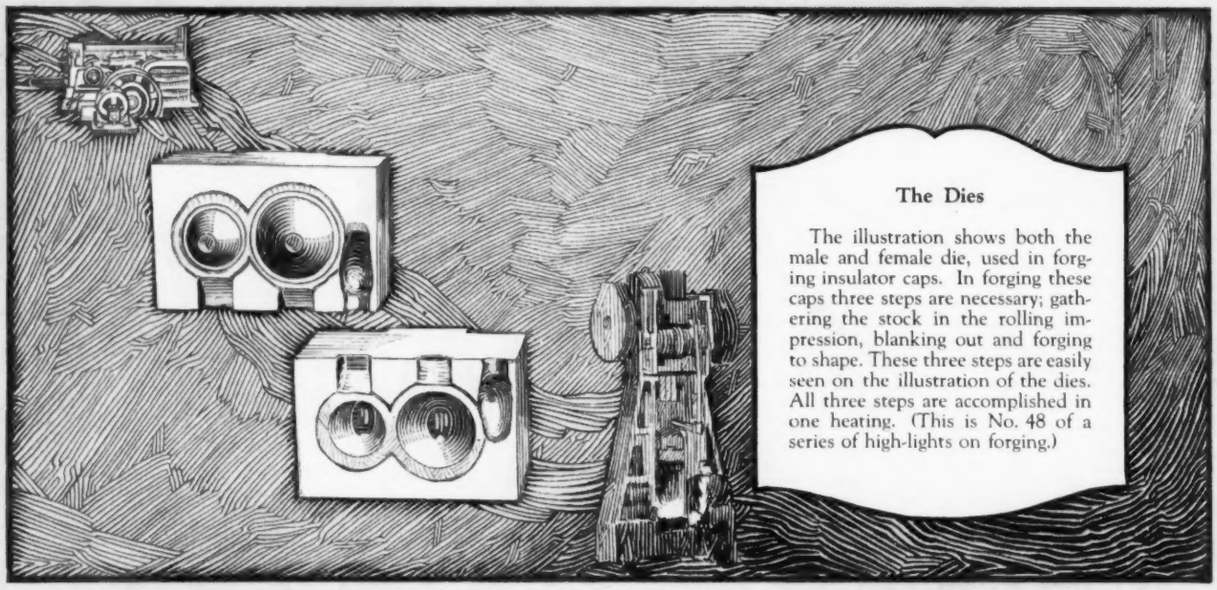
How many do you use?

& CABLE COMPANY

Chicago Office: 20 North Wacker Drive

Principal Cities

Present Day Standards Demand Drop Forgings



The Dies

The illustration shows both the male and female die, used in forging insulator caps. In forging these caps three steps are necessary; gathering the stock in the rolling impression, blanking out and forging to shape. These three steps are easily seen on the illustration of the dies. All three steps are accomplished in one heating. (This is No. 48 of a series of high-lights on forging.)

Forging To A New Demand

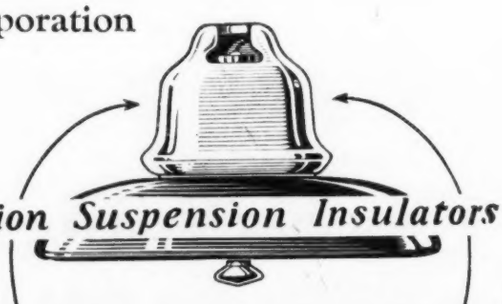
BECAUSE of the necessity for strong, dependable metal parts, the automotive industry acted as an incentive to the forging expert. Under this influence many difficulties were overcome and rapid advancement made.

Now comes a new demand—that of the electrical industry. The Brewer-Titchener Corporation, realizing the need for strong, uniform hardware, has made an intensive study of the electrical industry and its needs. With an early start and the intimate contacting of the engineer, these forging experts have successfully designed and forged hardware to suit the most exacting Engineer. Once successfully worked out, forgings are always strong, uniform, and accurate. All BTC drop forged hardware is made from S.A.E. 1035 Copper-Bearing Steel, to resist corrosion.

Why a Drop Forged Cap?

1. They are uniform in quality
2. They are superior in strength
3. They are made of anti-corrosive steel
4. They are uniform in dimensions
5. They can be heat treated to give maximum strength with minimum weight
6. They have precision milled joints and drilled holes
7. They allow a smooth, even porcelain seat
8. They are free from hidden defects and concealed flaws

The Brewer-Titchener Corporation
Cortland, New York



For High Tension Suspension Insulators

Specify BTC Drop Forged Caps

Now Berkeley Chooses Fluted Steel POLES

Berkeley, California, is noted for its beautiful thoroughfares

REPLACING other poles and individual lighting standards, Union Metal Heavy Duty Poles have transformed the appearance of San Pablo Avenue in Berkeley, California.

These 32-foot poles perform their numerous duties safely and with a minimum of attention. Slender, straight and uniform, they represent the ideal method of carrying electrical services through city streets.

In Berkeley the Union Metal Poles are equipped with twin street lighting units, cross arms, trolley span-wire supports and concealed cable-risers. In numerous other cities they are also used for a multitude of duties — often at a great saving in cost and always to the betterment of street appearance.

If you are not familiar with this advanced type of pole write for complete information.

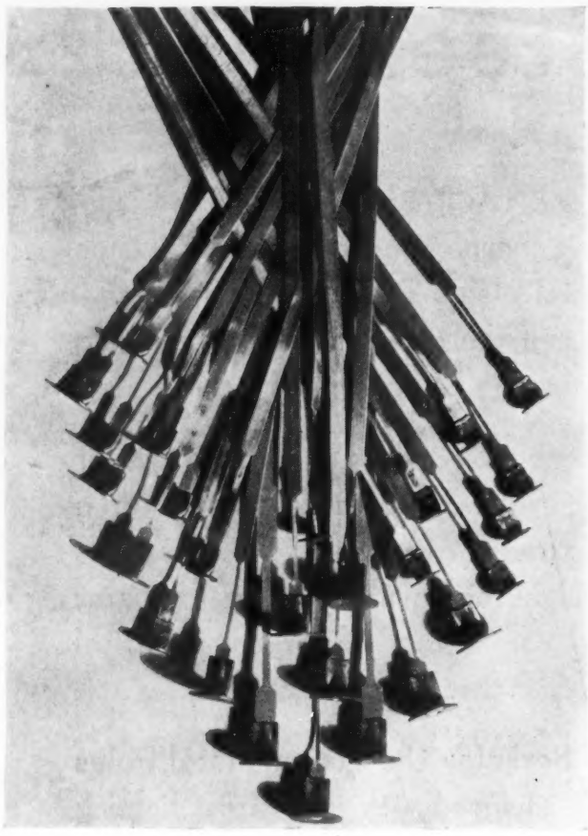
THE UNION METAL MANUFACTURING COMPANY
GENERAL OFFICES AND FACTORY ◆ CANTON, OHIO
SALES OFFICES: New York, Chicago, Cleveland, Boston, Los Angeles, San Francisco, Seattle, Dallas, Atlanta

DISTRIBUTORS
General Electric Merchandise Distributors — Graybar Electric Company, Inc.
Offices in all principal cities

Distributed by GraybaR

UNION METAL DISTRIBUTION POLES

The Heart of a Fuswitch or Cutout Is the Fuse Link



More failures of cutouts to function properly have been caused by poorly designed and inaccurately made fuse links than from any other reason.

During the past two years our engineers have been cooperating with a number of the engineers of the larger power companies on the design of a series of Fast Blowing Universal Fuse Links. These links will function better in Matthews Fuswitches and Cutouts. They will fit other makes of wet process porcelain housed cutouts and will function well in all of them. If you have several makes of cutouts on your lines, you can

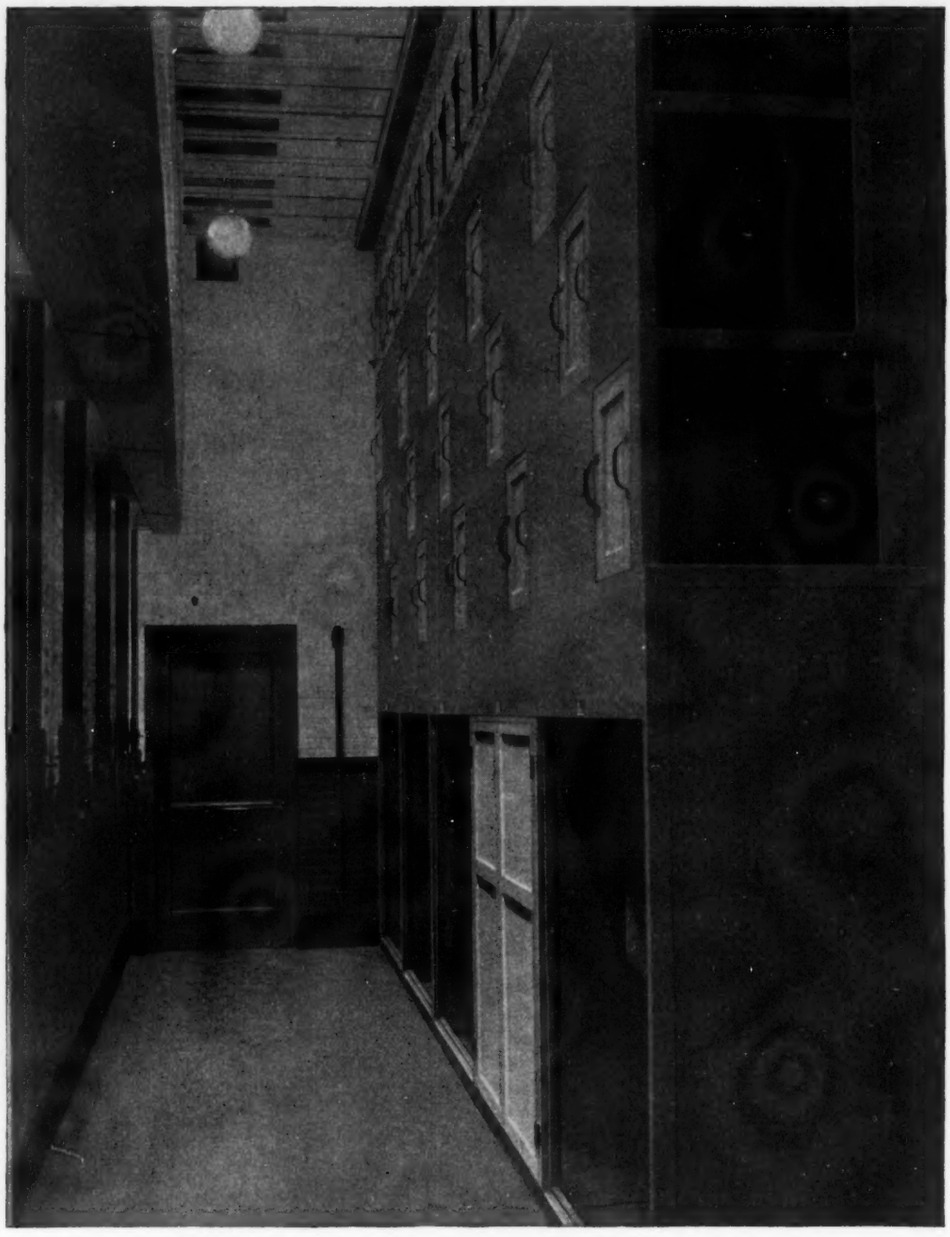
adopt these new Fast Blowing Universal Matthews Fuse Links and Matthews Fuswitches or Cutouts and use these links in all of them. Your men will have the best links made and need not carry several makes with them or make up a link of their own design, because they happen to have the wrong make with them. Company after company have tested these Fast Blowing Universal Matthews Fuse Links and have standardized on them. When will you give them a trial? They will save you money. Send in an order for 25 of each size that you use. You get a 5% discount on lots of 25 of any size.

W. N. MATTHEWS CORPORATION

Engineers and Manufacturers

ST. LOUIS, MO.

SAFE—COMPACT—TROUBLE-PROOF



THE fact that Alberene Stone Cell Structures are safe against fire and flame is one important reason for their wide-spread adoption by utilities.

Then too, there are no restrictions as to *planning* when Alberene Stone is used.

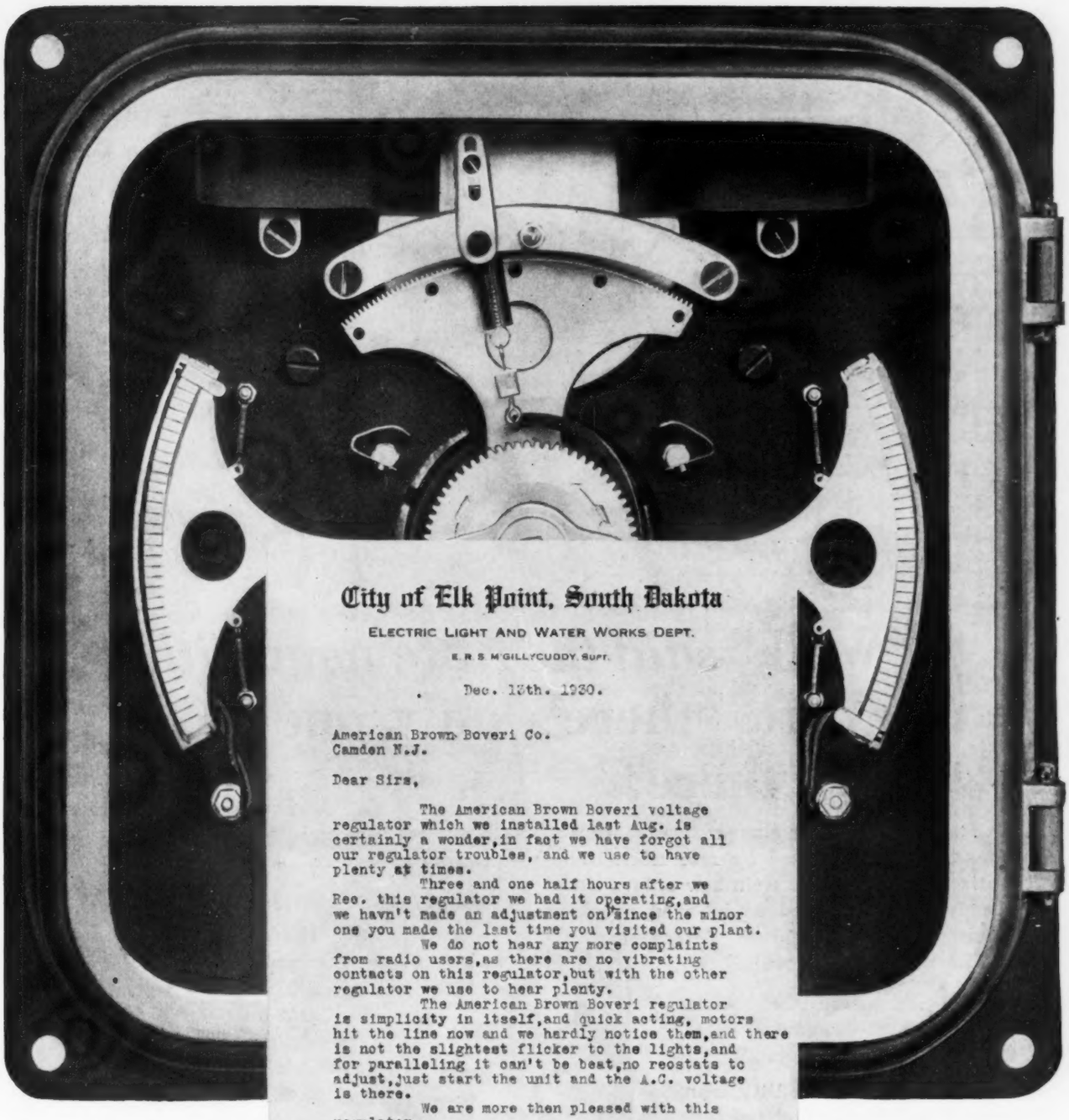
The slabs of stone are accurately machined and finished at the mill according to the design of the engineer and are delivered to the job ready for easy and quick assembly, and a clean, tight structure is assured.

Overall space is reduced, or more space can be allowed for clearance in each compartment, when two-inch thick Alberene walls are selected.

Our Sales Engineers will welcome the opportunity of giving you complete facts about these economical cell structures, or perhaps a copy of "Simplified Station Construction" will give you the data you require at present.

ALBERENE STONE COMPANY, 153 West 23d St., New York
Branches: **Chicago; Cleveland; Pittsburgh; Newark, N. J.; Washington, D. C.; Philadelphia; Boston; Rochester; Richmond. ▲ ▲ Quarries and Mills at Schuyler, Virginia.**

ALBERENE STONE
CELL STRUCTURES



City of Elk Point, South Dakota

ELECTRIC LIGHT AND WATER WORKS DEPT.

E. R. S. M'GILLYCUDDY, Supt.

Dec. 13th. 1930.

American Brown Boveri Co.
Camden N.J.

Dear Sirs,

The American Brown Boveri voltage regulator which we installed last Aug. is certainly a wonder, in fact we have forgot all our regulator troubles, and we use to have plenty at times.

Three and one half hours after we Rec. this regulator we had it operating, and we havn't made an adjustment on it since the minor one you made the last time you visited our plant.

We do not hear any more complaints from radio users, as there are no vibrating contacts on this regulator, but with the other regulator we use to hear plenty.

The American Brown Boveri regulator is simplicity in itself, and quick acting, motors hit the line now and we hardly notice them, and there is not the slightest flicker to the lights, and for paralleling it can't be beat, no reostats to adjust, just start the unit and the A.C. voltage is there.

We are more then pleased with this regulator.

Yours Truly,

E. R. S. M'Gillycuddy, Sup't.

This was a nice letter to receive—especially since it was unsolicited and entirely unexpected. But then, the A. B. B. voltage regulator writes nice things, too—in the performance record of every generator it regulates.

AMERICAN BROWN BOVERI CO., INC., CAMDEN, N. J.

AMERICAN BROWN BOVERI

"Well," *said the little man with a Colt,* "there's only one riot, ain't there?"

A frantic call for the Rangers was sent by a Texas town, terrorized by race riots. The citizens who met the train saw only a little bandy-legged, wizened, squint-eyed, wrinkle-faced, leather-skinned runt. "Here I am," he said. "What's the trouble?"

"But," stammered the spokesman for the reception committee, "there is only one of you."

"Well," answered the little man, slowly shifting his cud and resting his hand on the butt of a Colt, *"there's only one riot, ain't there?"*

Men in those days, as now, depended on the Colt for protection. And they depended on it to enforce law and order. Colt protection always has been real and vital.

Today, Colt is protecting electrical equipment with the NOARK line of safety switches and meter protective devices. The NOARK products are part of the Colt family—Colt built and receiving the attention that has made Colt famous for the manufacture of things mechanical.

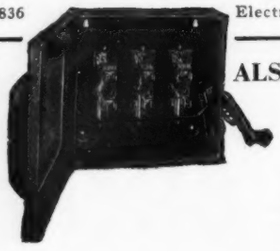
In the NOARK line, skilled men and special machinery find an outlet for utilizing the watch-like methods of precision that prevail throughout the great Colt plants. NOARK is just another form of Colt protection.

COLT NOARK

COLT'S PATENT FIRE ARMS MFG. CO., Established 1836

***Electrical Division*, HARTFORD, CONN., U.S.A.** Electrical Division 1886

NOARK NUBLADE SWITCHES CAN ALSO BE DEPENDED UPON IN A PINCH

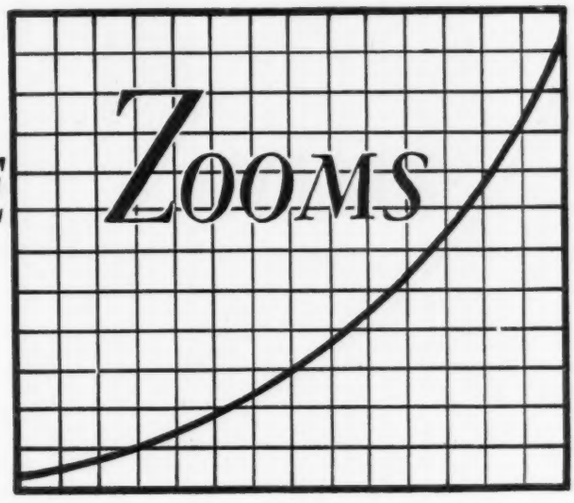


Reduced maintenance costs with NOARK Nublade Switches. Quick-make and quick-break—renewable unit block construction—compact in size—generous wiring room—plenty of easily removed knockouts — moderate in price and ... A Colt Product.

Send for Catalog "A" and detailed description. "The Rampant Colt," an interesting publication, mailed on request.

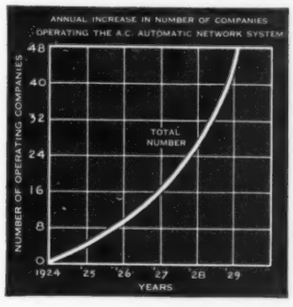
M-11

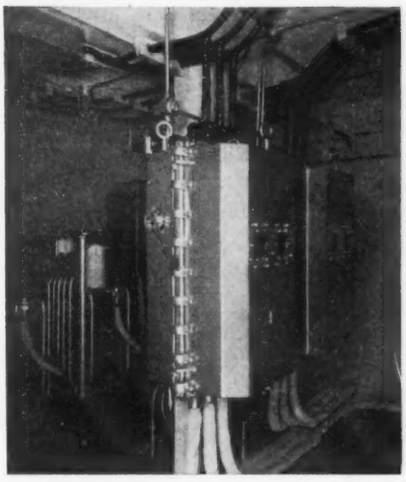
WHEN THE DOWNTOWN LOAD-CURVE ZOOMS



WHEN your underground distribution channels are filled to capacity with cables already straining to carry the load, with consequent loss of efficiency—and building activity curves are mounting upward—then your distribution problems become most complex.

The solution of this problem lies in the a-c., low voltage network system. This system eliminates expensive downtown substations and decreases the required copper cross section by a ratio approximately equal to feeder voltages. Because light and power loads are fed from the same mains, it reduces total annual charges and provides great flexibility in expansion and better service continuity. The small curve at the left portrays the remarkable growth of the a-c. system—a significant measure of its merit.





An installation of CM-2 submersible network protectors on the San Antonio Public Service Co. system. Note the use of sheath cable and porcelain bushings at top of the protector.

Westinghouse pioneered the use of a-c. networks and developed and brought to its present high state of efficiency the network protector—the key to the success of this system.

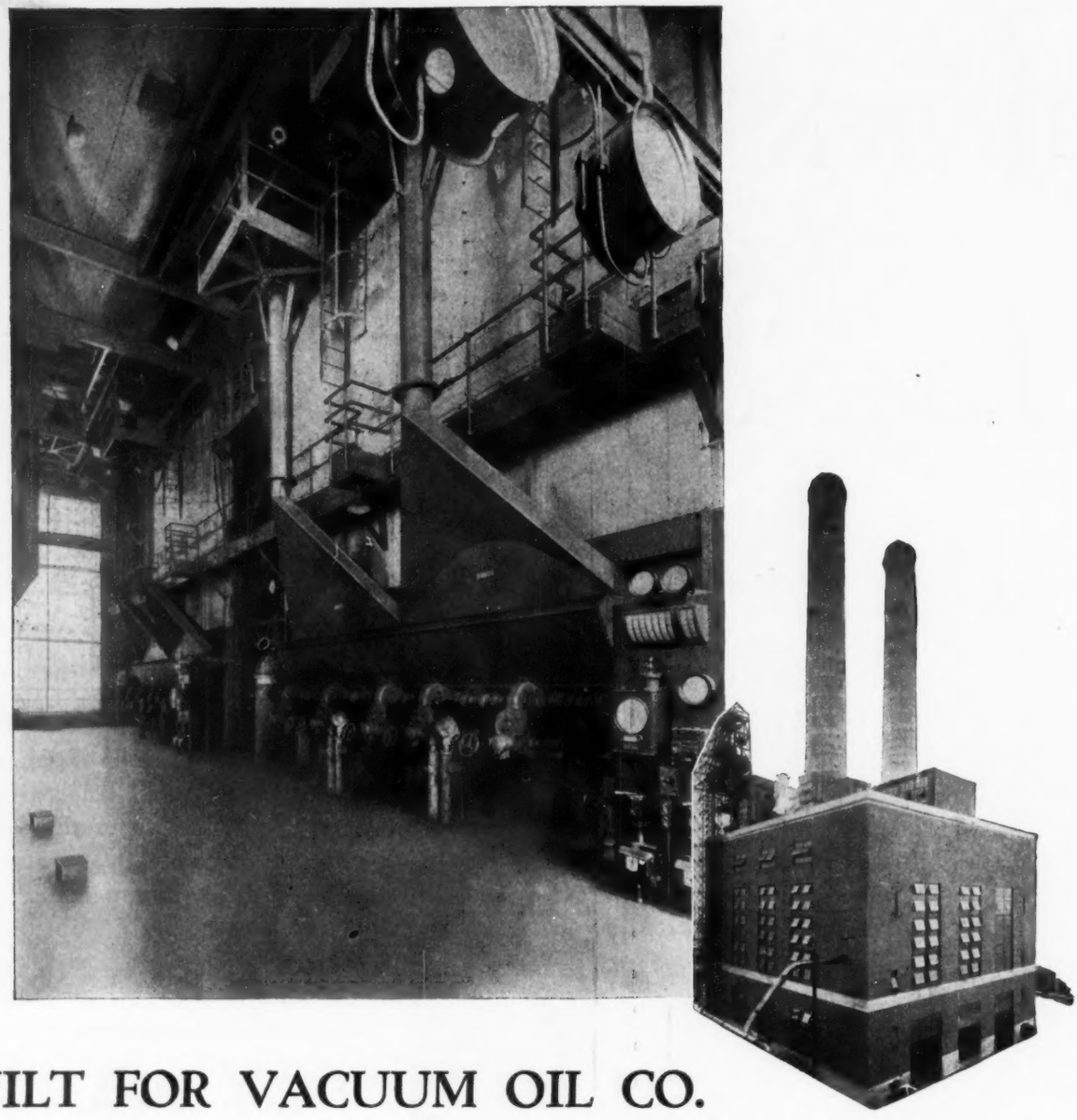
Circular 1837 fully describes the modern CM-2 network protector. Request it from our nearest office.

Service, prompt and efficient, by a coast-to-coast chain of well-equipped shops

Westinghouse

T 31380

TUNE IN THE WESTINGHOUSE SALUTE OVER THE N. B. C. NATION-WIDE NETWORK EVERY TUESDAY EVENING.



BUILT FOR VACUUM OIL CO.

This boiler plant erected for the Vacuum Oil Company at their Paulsboro, N. J., Oil Refining plant, supplies steam for process and electric power purposes. The building is 106′ x 108′ x 80′ high, of steel frame with exterior brick walls and concrete floors. The plant includes 3-1732 h. p. cross drum water tube boilers of maximum working steam pressure of 450 lbs., each equipped with superheaters, economizers, underfeed stokers and the necessary auxiliary equipment. The coal handling system has a capacity of 120 tons of coal per hour. Process steam is distributed to the various buildings through overhead steam lines on steel supports. One 3,000 kw. 80% p. f. horizontal non-condensing turbo generator was installed in the existing power house. Current is generated at 2300 volts, 3 phase, 60 cycle. This unit operates at 400 lbs. pressure, and exhausts at 190 lbs. gauge to the refining steam distribution lines.

Construction was started in February and the station was operating in November of the same year.

STONE & WEBSTER ENGINEERING CORPORATION

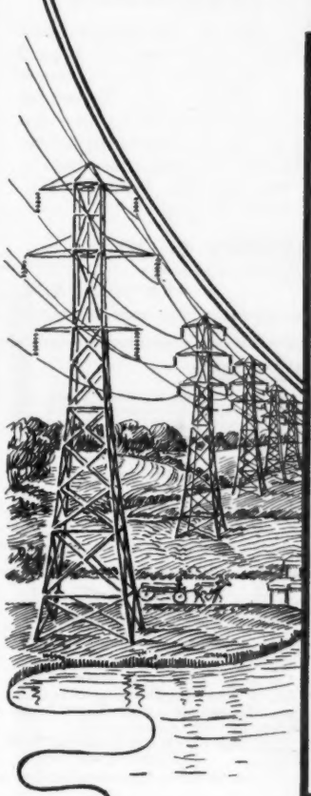
A SUBSIDIARY *of* STONE & WEBSTER, INCORPORATED

BUILDERS *and* ENGINEERS *For the* BUSINESS LEADERS *of* AMERICA

Associated in Canada with WILLIAM McCLELLAN and COMPANY, LIMITED, Montreal

20 YEARS' EXPERIENCE— FULL EQUIPMENT—

At Your Service for Steel Tower — Wood Pole — Or Underground Transmission Line Construction



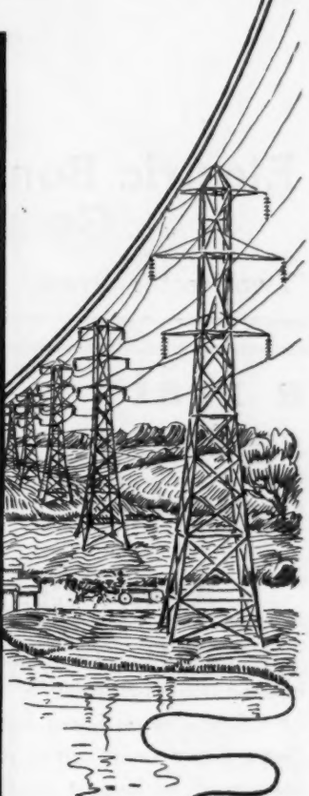
THE Kelso-Wagner Co. is ready to provide for you quickly a complete, thoroughly experienced, ably directed transmission building service.

Our service is well organized and well trained through years of experience. It saves you money, and no end of grief and trouble by taking over the whole job. You do not have to search for men, build and organize crews—your line crews can be kept to minimum.

You may purchase materials, or our organization will make all purchases according to your specifications.

Let our engineers confer with you on your next job—we will furnish an estimate for the complete job—steel tower—wood pole—underground—or substation.

WRITE TODAY



THE KELSO-WAGNER COMPANY---- DAYTON, OHIO

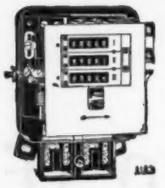
WE EXTEND the facilities of our organization to those desiring information or reports on companies with which we are identified.

Electric Bond and Share Company

Two Rector Street — New York

3-Rate Meter

Information on 2-rate and 3-rate meters on request. (Type FBodm is the 2-rate meter.)



Type CBot single phase 3-rate watthour meter.

The Largest Line of Electricity Meters in the World

LANDIS & GYR, INC.

Herbert Nehls, V. P. and G. M.

104 Fifth Ave., New York

A Siemens and Halske product

PARAGON

Constant Pressure

Megohmer

Combines the greatest possible sensitivity with rugged construction. Magnets made of cobalt steel. Generator may be removed without disturbing the measuring instrument. Bakelite case made in two sections. Send for Bulletin No. 195.

HERMAN H. STICHT & CO.

Electrical and Industrial Instruments

19 PARK ROW — NEW YORK, N. Y.

a real seller!

½-watt

NEON GLOW LAMP

The ½-watt Neon Glow Lamp meets the demand for economical performance. Sturdily built — millions of vibrations will not harm it — the little ½-watt Neon Glow Lamp gives more than 3,000 hours of service at an almost negligible cost. And it has a host of uses. As a pilot light, indicator or handy test lamp, in annunciator on call systems and for many other special purposes. Fits standard socket and runs direct on 110 A. C. Sales and profits possibilities of the Neon Glow Lamp will interest you. For details and prices write: General Electric Vapor Lamp Company, 805 Adams Street, Hoboken, N. J.

GENERAL ELECTRIC VAPOR LAMP COMPANY

(Formerly Cooper Hewitt Electric Company)

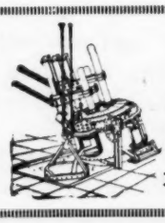
476A © G. E. V. L. Co., 1930

C. H. WHEELER

We manufacture Surface, Jet and Barometric Condensers; Leach Fracto Control Condensers; Oil Vapor Condensers; Heat Exchangers; Ejector Type Air Pumps for Vacua up to 29.95 inches; Forced and Natural Draft Cooling Towers. Our service embraces the entire range of condenser practice—industrial and utility.

C. H. WHEELER MFG. CO., 19th St., Lehigh and Sedgley Aves., Philadelphia, Pa.

of PHILADELPHIA



Moore Rapid Electromelt Furnaces

Ten Standard Sizes ½ to 24 Tons Capacity

Most Rapid and efficient for making Tool Steels, Alloy Steels, Forging Steels Steel Castings, Malleable Iron, Grey Iron Carbide, Ferro-Alloys etc.

PITTSBURGH ELECTRIC FURNACE CORPORATION

P.O. Box 1125. PITTSBURGH, PA.

"Bates Poles Outlive the Bond Issues that Buy Them"

BATES POLES AND STRUCTURES

Bates Expanded Steel Corp.

General Offices and Plants

EAST CHICAGO, INDIANA, U. S. A.

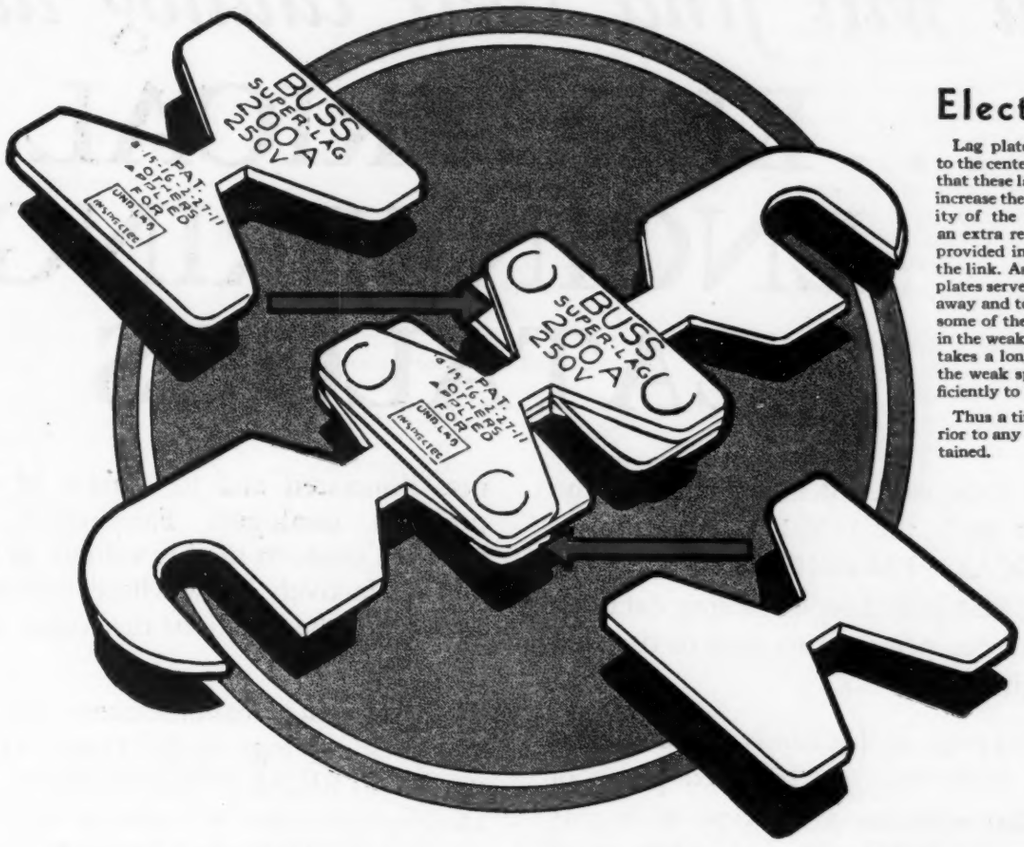
RUGGED DISC INSULATORS

PROTECT WITH JD TO A GREATER DEGREE."

JEFFERY-DEWITT INSULATOR CO. KENOVA, W. VA. U. S. A.

THICKER PORCELAIN FOR POWER TRANSMISSION SERVICE

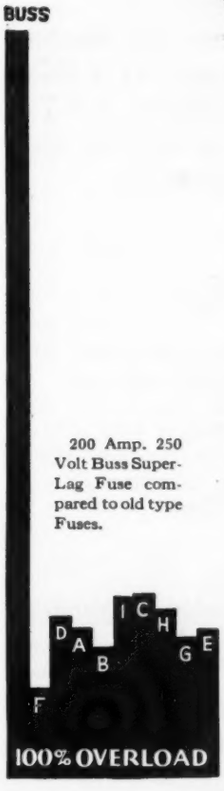
WHY IT WORKS



Electrically

Lag plates are attached to the center of the link. So that these lag plates do not increase the carrying capacity of the link too much, an extra reduced section is provided in the center of the link. As a result the lag plates serve only to conduct away and temporarily store some of the heat generated in the weak spots, so that it takes a longer time to get the weak spots heated sufficiently to blow.

Thus a time-lag far superior to any other fuse is obtained.



200 Amp. 250 Volt Buss Super-Lag Fuse compared to old type Fuses.

To Save the User Money

IN the every day operation of an electrical circuit there are bound to occur many temporary overloads which in themselves would not be harmful to wiring or equipment and would not cause an interruption of service.

When fuses blow needlessly on such harmless overloads, because of a short time-lag, they cause unnecessary and costly shut-downs.

By increasing the time-lag—the time required to blow the fuse—BUSS SUPER-LAG Fuses safely carry many of these temporary or harmless overloads without blowing. Yet the design is such that they give positive protection against dangerous overloads and short-circuit conditions superior to that of any other fuse.

By reducing the number of needless blows BUSS SUPER-LAG Fuses increase operating efficiency. No longer need machines stop, workmen stand idle and production cease because a fuse blew due to short time-lag.

GLANCE AT THE CHART

An indication of what BUSS SUPER-LAG Fuses mean to the user because of their superior time-lag can be seen from the chart on the left which shows how they compare with others. This chart is based upon tests made by the Electrical Testing Laboratories of New York and reported by them on August 25th, 1930. It shows how a 200 ampere 250 volt BUSS SUPER-LAG Fuse compares with other fuses at 100% overload.

30, 60, 100, 400 and 600 ampere sizes show similar results.

YOU BE THE JUDGE

The only true way to judge what the SUPER time-lag of BUSS Fuses will mean to the user is to put the fuses on trial in actual service.

The user who does this will find out-of-service losses decreased and a material reduction in the cost of his fuse protection.

If you would like more complete information about BUSS SUPER-LAG Fuses before trying them in service we will be glad to have a BUSS Representative call on you or send complete data by mail.

Let us know your preference.

THE BUSSMANN MANUFACTURING COMPANY, 2536 W. University St., St. Louis, Mo. FUSE

A Division of the McGraw Electric Company

BUSS SUPER-LAG

You will find their catalog data in . . . . ELECTRICAL ENGINEERING CATALOGS

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IF YOU are qualified for position between $2,500 and $25,000, and are receptive to negotiations for new connection, your response to this announcement is invited. The undersigned provides a thoroughly organized service established twenty-one years ago, to conduct confidential preliminaries, and assist the qualified man in locating the particular position he desires. Not a registration bureau. Retaining fee protected by refund provision, as stipulated in our agreement. Send name and address only for description of service. R. W. Bixby, Inc., 262 Main Street, Buffalo, N. Y.

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U. S. Government

TREASURY DEPARTMENT, Office of the Supervising Architect, Washington, D. C., December 16, 1930.—Sealed proposals will be opened in this office at 3 p.m., January 13, 1931, for furnishing the materials and performing the work required for installing one passenger elevator in the U. S. P. O., Ct. H., etc., extension and remodeling, at Salisbury, N. C. All prospective bidders are hereby notified that, unless the following information has been furnished within the last year on some other project for the Treasury Department, any bid submitted in response to this advertisement must be accompanied by a statement of facts in detail of the business and technical organization of the bidder available for the contemplated work, including financial resources and building experience, etc. The United States expressly reserves the right to reject any bid in which the facts as to business and technical organization, financial resources or building experience compared with the project bid upon, justify such rejection. The successful bidder will be required to furnish a performance bond of 50% of the contract price. Drawings and specifications may be obtained from this office. JAS. A. WETMORE, Acting Supervising Architect.

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242 Takoma Ave., Washington, D. C.

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Variable Speed—230 Volt—D. C.

1—200-hp. Allis-Chalmers Interpole, 500/1000.
1—150-hp. Westgh. SK-201, 400/800 r.p.m.
1—100/125-hp. Crocker-Wheeler, CMC-101H, 600/1200 r.p.m.
1—100-hp. Westgh. SK-200, 250/700.
2—100-hp. Westgh. SK, 300/1200.
1—75/100-hp. Westgh. SK-210, 200/600.
1—75/100-hp. Crocker-Wheeler, CMC, 500/1000.
2—50-hp Westgh. SK-190, 225/450.
2—35/45-hp. Gen. Elec. RLC-203, 500/1500.
1—25/30-hp. Electro Dyn. 20-S, 400/1200.
3—20/25-hp Gen Elec. RF-12, 500/1500.
5—15/20-hp. Westgh. SK-110 L, 500/1500.
4—10/14-hp. Gen. Elec. RLC-116, 400/1600.
12—10-hp. Westgh. SK-90, 500/1500.
3—7½/10-hp. G. E. NEW, RF-10, 400/1200.
See last week's listing

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Belyea Co., Inc. 151 W. 18th St. New York City

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AVAILABLE AT LOW COST

3 unit direct connected set consisting of Star 40 hp., 3 phase, 220 volts, 60 cycle induction motor; 115 v., 87 amp., d.c. generator, and 350 v., 40 amp. d.c. generator.

3 unit set, G.E. 40 hp., 3 phase, 220 volts, 60 cycle, Type KT induction motor with 650 v., 10 kw., d.c. generator, and 120 v., 10 kw., d.c. generator.

Equipment in Good Condition

Radiomarine Corporation
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Electric Dynamometer

About 30 hp. at 2,500 r.p.m. to test small automobile engines. Send particulars to

HILLES LABORATORY
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1—Direct connected 70-100 kw., 3 phase, 220 volt, 60 cycle generator, exciter and switchboard.
Give dimensions.

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1—500 kw., 250 v. Westinghouse Synchronous motor Generator Set.
1—300 kw., 125 v., 3-wire, 3-unit, Ridgeway.
1—250 kw., 230 v., 3 ph., 60 cy., 2300-4600 v. Synchronous Motor Generator set.
1—200 kw., 230 v., 3 ph., 60 cy., 2300-4100 v Synchronous Motor Generator set.
1—150 kw., 600 r.p.m., 250 v., Gen., 3 ph., 60 cy., 220-440 v., G. E. Synchronous motor.
1—125 kw., 250 v. Westinghouse Synchronous Gen, Motor Set, 3 ph., 60 cy., 230-2200 v.
1—100 kw., 125 v., D. C. 220-440 A.C. G.E. Synchronous Motor Generator Set, 220-440 v.
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TURBINES

1—75 kva., 3 ph., 60 cy. Westinghouse Geared Non-Condensing Turbine.

TRANSFORMERS

1—1500/3000 kva. G. E. combined oil and water cooled 3 ph., 60 cy., 11000-22000-2300 v.
3—500 kva. G. E. 13000/26000—220/440.

A. C. GENERATORS

No.	*Kw.*	*R.p.m.*	*Volts*	*Ph.*	*Type*
1	400	900	2300/4000	3	Westg.
1	350	600	440	3	Westg.
2	125	900	2300	3	Cr.-Wh.
2	100	900	230-2300	3	G.E.
1	75	600	220	3	Westg.
1	75	900	2300	3	G.E.
1	50	1200	220-440-2300	3	G.E.

MOTORS—3 Phase, 60 Cycle

No.	*Hp.*	*R.p.m.*	*Volts*	*Type*
1	500	900	440/4000	(Westg. Syn. Con.)
1	500	900	440	G.E. syn.
1	350	900	2200/4000	Wh. syn.
2	300	600	445-2300	G.E. syn.
1	250	600	2200/4000	G.E. syn.
1	250	600	220-440	Westg. syn.
1	250	600	440-2200	G.E. syn.
3	200	514	4150-2300	G.E. syn.
2	175	3 ph.	60 cy	2300 volts, G.E.
4	150	1200	220/440	Westg. rg.
1	150	900	2300	G.E. syn.
2	150	514	2200	Westg. sl.rg.
1	150	1800	2200	Westg. sq.cg. mtr.
1	100	900	440-2200	G.E. sq. cg.
1	100	900	220-440-220	Westg. sq. cg.

D.C. Generators

No.	*Kw.*	*R.p.m.*	*Volts*	*Type*
1	200	900	250	G.E.
1	200	600	250	G.E.
1	200	525	250	G.E.
2	150	1200	250	Cr.-Wheeler
1	150	600	250	G.E.
2	150	1200	250	Westg., new
1	100	720	250	G.E.
1	75	450	250	Diehl

(Smaller Sizes on Request)

D.C. MOTORS—230 VOLT

No.	*Hp.*	*R.p.m.*	*Type*
1	250	550	G.E.
2	200	1150	Cr.-Wheeler
1	150	600	G.E.
3	150	850	Westg. SK, new
1	150	1100	Westg. SK.
1	125	550	Cr.-Wheeler
1	100	625	Westg. Type S

(Smaller Sizes on Request)

D.C. MOTORS—125 VOLT

No.	*Hp*	*R.p.m.*	*Type*
1	125	575	G.E.
1	100	600	G.E.
1	80	600	G.E.

HIGH GRADE STANDARD EQUIPMENT

SLIP-RING MOTORS—3 Ph. 60 Cy.

Hp.	*Volts*	*Make*	*Speed*
500	2200	G.E.	900
350	2200-440-220	G.E.	720
220	220-440	G.E.	450
200	2200-440-220	G.E.	600
150	220-440	G.E.	720
150	220-440	Westghse	1200
150	220-440-550	G.E.	600
100	2200	Westghse.	900
100	550	G.E.	720
100	440-220	G.E.	720
100	440-220	G.E.	900

SYNCHRONOUS MOTORS—3 Ph., 60 Cy.

Hp	*Volts*	*Make*	*Speed*
325	2200-440	G.E.	200
300	440	G.E.	225
240	2200-440	G.E.	720
150	2300-4000	G.E.	900
110	2200-550	G.E.	900
80	2200-440-220	G.E.	1200
60	440-220	Westghse.	1200

MOTOR GENERATOR SETS AND ROTARY CONVERTERS

1—165-kw., 125-250-v., 6-ph., 60-cy., 1200-r.p.m. G.E., with 2300-4000-v., 3-ph., transformer.
1—100-kw., 250-v., 3-ph., 60-cy., 1200-r.p.m. Westghse., with 2300-v. transformer.
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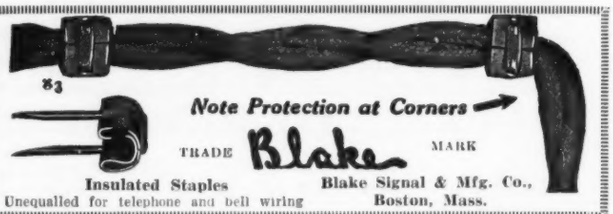

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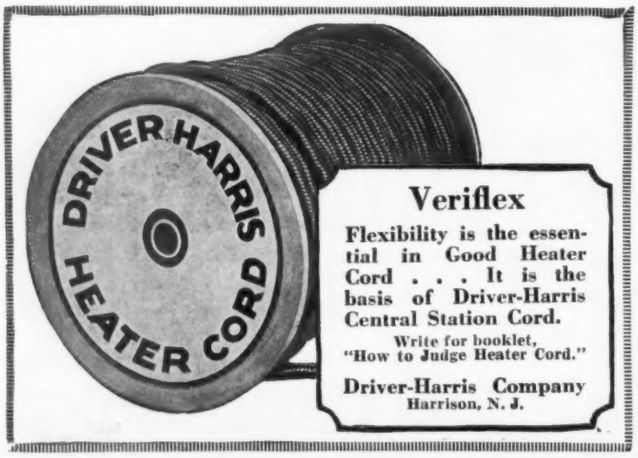

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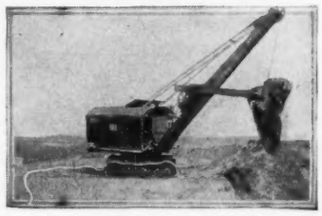

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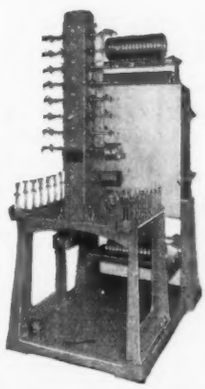

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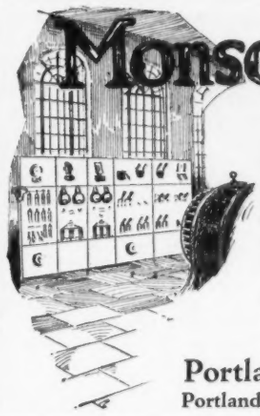

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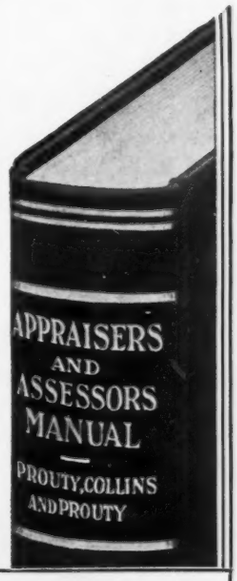

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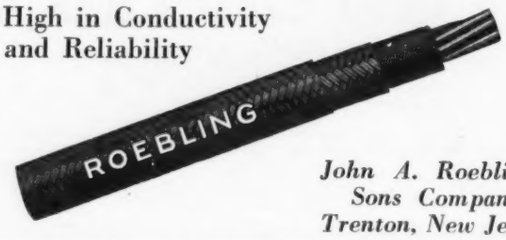

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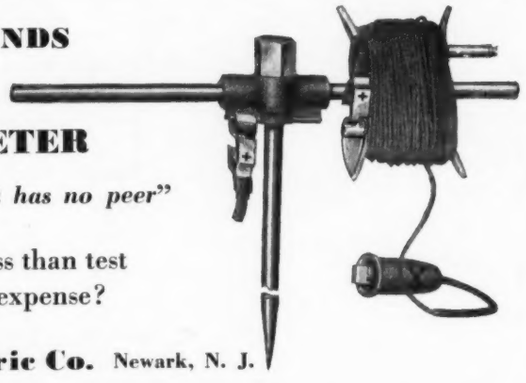

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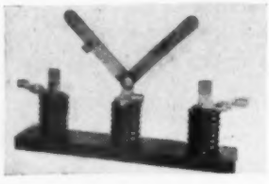

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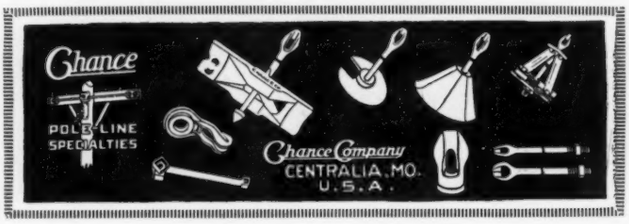

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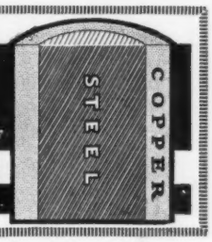

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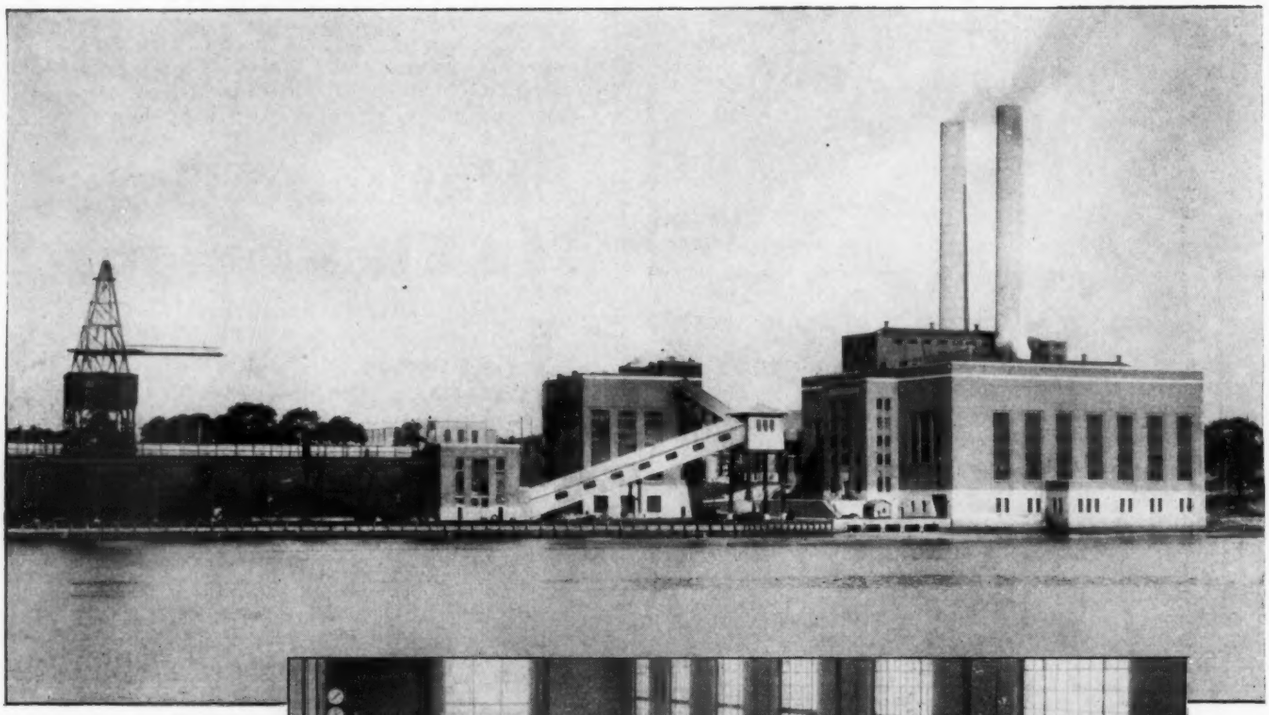

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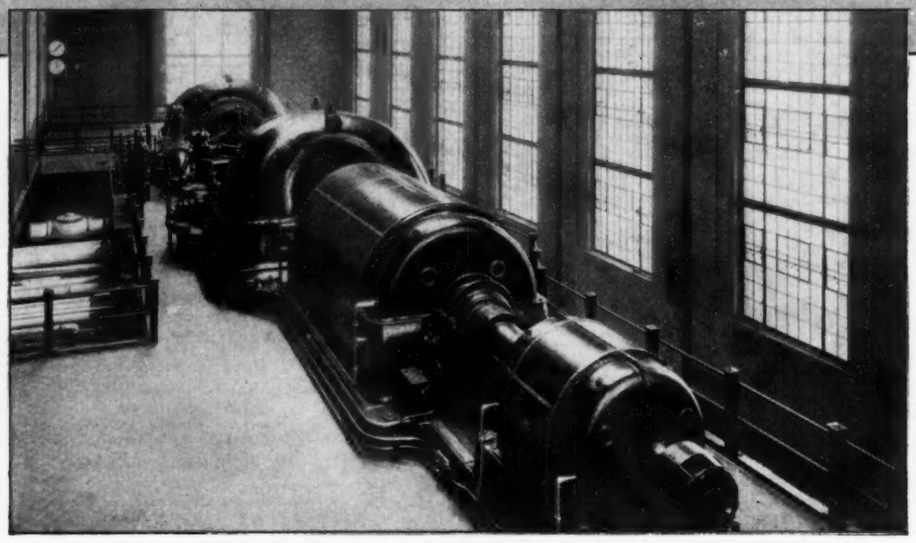


Turbine room of Somerset Power Station
where Gargoyle D. T. E. Oils are used

GARGOYLE

Lubricating Oils

The World's Quality Oils
for Plant Lubrication

Yes! It uses Gargoyle D.T.E. Oils

Trim and efficient from coal-dock to smoke-stacks, the Somerset Station of the Montaup Electric Company was designed and built by the Stone and Webster Engineering Corporation to supply power to three associated electric companies in two states.

The total rated capacity of the station is 77,000 k.w. Power is distributed by six 66,000-volt transmission lines.

In keeping with the modern engineering design and equipment of the station, Gargoyle D.T.E. Oils were selected for the lubrication of generating turbines and other machinery. It is significant that such a long list of the better-equipped power stations throughout the world use Gargoyle lubricants exclusively.

Whatever the type of prime mover, the complete line of Gargoyle lubricants affords lubrication exactly suited to the particular needs. Dependable service and long life of expensive equipment demand something better than "just as good" lubrication.

We will be pleased to have you ask us for economy and service records of stations near you that use Gargoyle lubricants and Vacuum engineering service.

Many power plant operators have found these technical treatises particularly helpful. We will be glad to send either or both of them, without obligation, to anyone in your plant.

Vacuum Oil Company

Headquarters: 61 BROADWAY, NEW YORK

Branches and distributing warehouses throughout the world

Two Kinds of Editors—

bring you the news you read in your Business Paper . . .

TWO KINDS of news go into a business paper. One kind is the news that you read in the editorial pages —news of new ideas, new practices and plans.

The other is the news you need in the advertising pages—news that tells you what to buy to put those plans into effect, news that tells you where to buy it and whom to buy it from.

* * *

TWO KINDS of men *make* your business paper. One is the editor, interpreting to *you* the news of your business or industry.

The other is the advertising representative, interpreting *you* and *your needs* to those in position to serve you. He studies as a group, readers of the paper he represents. Then he goes to the makers of merchandise and machinery, of supplies and equipment. He tells them what *you* want to know about the things *they* have to sell. He guides them in presenting the *news* of their products or their services. He helps them to sell efficiently. He helps you to buy intelligently. He renders an important service to them and to you.

If you are a reader and a buyer, profit by the news in the advertising pages of your business paper.

If you are a reader with something to sell, profit by the service of the advertising representative. Let him show you how to reach a rich, responsive, selected market for your product through the pages of the business press.

THIS SYMBOL *identifies an ABP paper . . . It stands for honest, known, paid circulation; straightforward business methods, and editorial standards that insure reader interest . . . These are the factors that make a valuable advertising medium.*

THIS PUBLICATION IS A MEMBER OF

THE ASSOCIATED BUSINESS PAPERS, INC.

TWO-NINETY-FIVE MADISON AVENUE - NEW YORK CITY

THE PART PLAYED BY I-R CONDENSERS IN CENTRAL STATION PROGRESS

In 1928, the Municipal Light and Power Department of the City of Pasadena placed in operation a 15,000-kw. turbo-generator unit, served by an Ingersoll-Rand surface condenser plant. Four years previous to this date, a 10,000-kw. unit was installed. This unit is also served by an Ingersoll-Rand condenser.

The circulating water with which these condensers are supplied is cooled in a natural draft cooling tower. The station was therefore laid out on the basis of using a minimum of circulating water because of its effect upon the size and cost of the cooling tower required.

The Ingersoll-Rand condenser is admirably suited for installations of this kind. Because of the many refinements in its design, which include external air coolers, a heart-shaped shell, and a positive control of the longitudinal distribution of steam flow, the I-R condenser will maintain exceptionally high vacuum with a minimum of circulating water.

For a more detailed description of the above station, write for pamphlet No. 1818.

INGERSOLL-RAND COMPANY, 11 BROADWAY, NEW YORK CITY

Ingersoll-Rand

51-SG

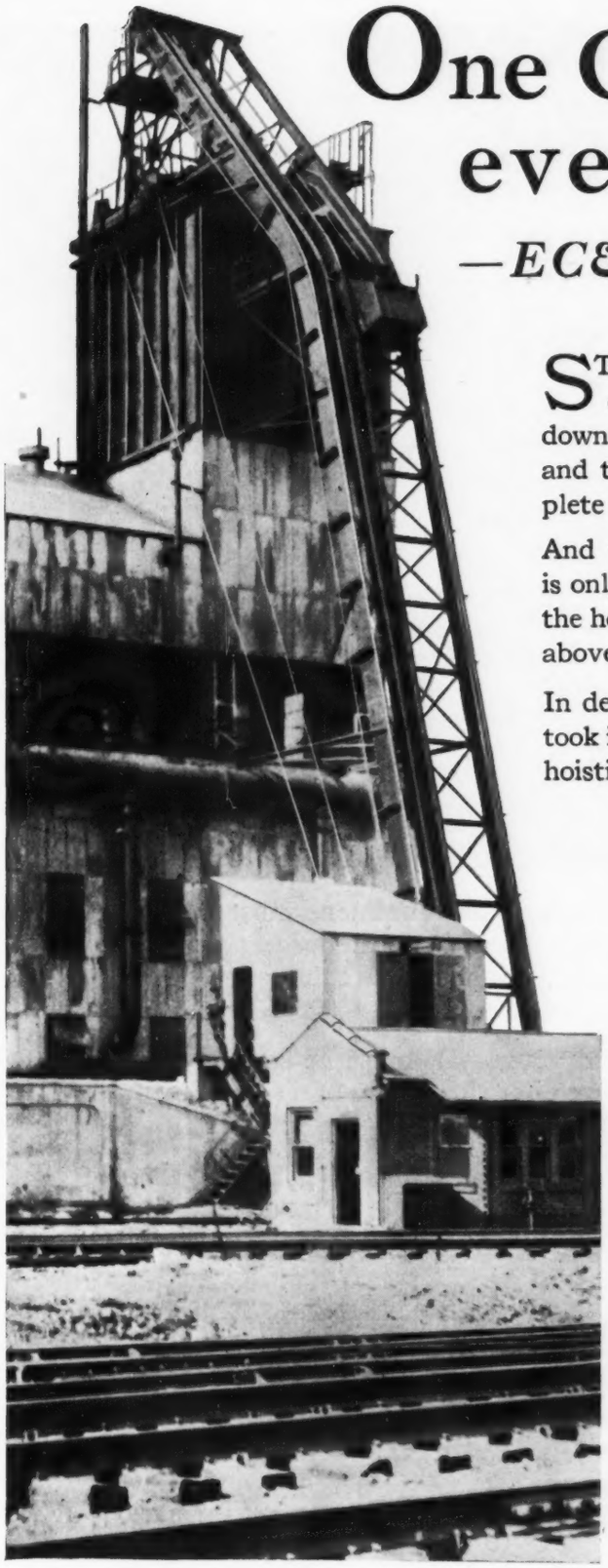
"I fully expect in time to light the whole city of New York by electricity",

said Thomas A. Edison, in the autumn of 1882, to a representative of *The Operator* (which two months afterwards changed its name to The *Electrical World*). Eighty-two houses were then being supplied in the down-town district.

The *Electrical World* of today contains equally prophetic utterances. And *more of them!* For electricity now not only lights, but practically *operates* the greater portion of the whole civilized world.

Electrical engineers and executives, who read the *Electrical World* today, are producing, distributing, applying and administering this modern magic . . . all over the globe.

Office buildings, hotels, factories, power plants, transportation and communication facilities, are built, equipped and operated under their directing influence.



One Complete Trip every 3 minutes

—*EC&M does it automatically*

START up slow, accelerate to full speed, slow down, stop, time-delay at top to dump, start down slow, accelerate to full speed, slow down, stop, and time-delay at bottom to fill bucket is the complete cycle of operation of this hoist.

And the operation is completely automatic . . . it is only necessary to start the cycle and once started, the hoist continues to operate in the manner outlined above until it is stopped.

In designing this control, EC&M Control Engineers took into consideration all of the characteristics of the hoisting machinery, the required accuracy of stopping either with a loaded, partially loaded or empty bucket and designed the control accordingly. This insured a minimum time per trip and the handling of maximum tonnage because the motor is accelerated, slowed down and stopped —accurately—in the fastest possible time during each cycle of operation.

Control problems like these, when solved, are interesting to relate, but they require good control engineering. With EC&M, you can always have exactly the right thing, because EC&M specializes in building the control precisely suited to the job. This is only one of the many interesting problems solved by EC&M. Write to our nearest office about your next control problem.

EC&M Type TN Traveling Nut Limit Switch used with an EC&M A.C. Magnetic Controller to provide this automatic operation.

THE ELECTRIC CONTROLLER & MFG. CO.

CLEVELAND, OHIO

NEW YORK-50 CHURCH ST.
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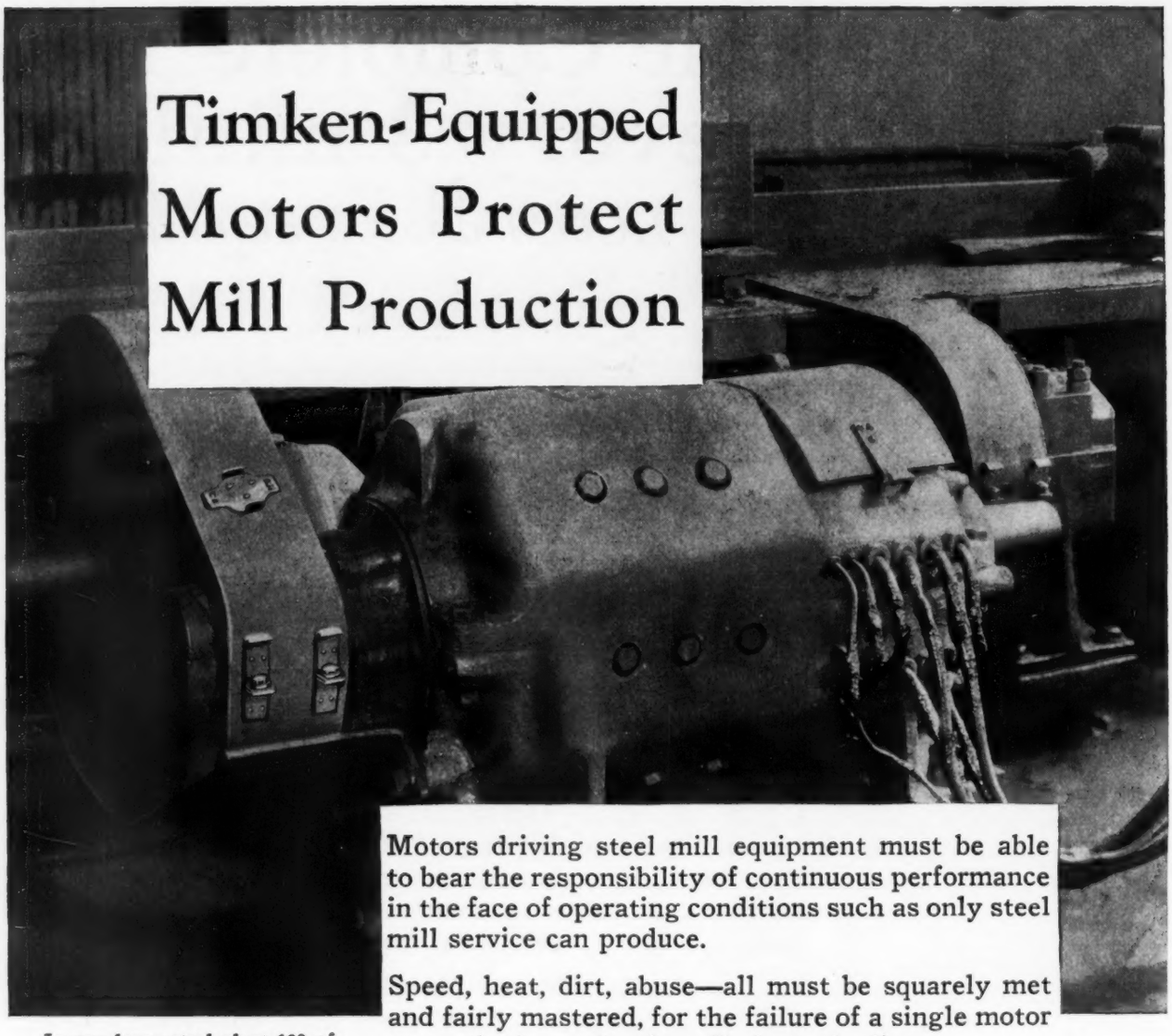
DETROIT-DIME BANK BLDG.
BIRMINGHAM-BROWN-MARX BLDG.
CINCINNATI-1ST NATIONAL BANK BLDG.
ST. LOUIS-6936 MARQUETTE AVE.
LOS ANGELES-912 E. THIRD ST.
HOUSTON-P.O. BOX 4182
TORONTO-REFORD BLDG.
PHILADELPHIA-WITHERSPOON BLDG.
PITTSBURGH-OLIVER BLDG.
SAN FRANCISCO-CALL BUILDING
MONTREAL-CASTLE BLDG.
TULSA-217 E. ARCHER ST.
SEATTLE-ALASKA BLDG.

Timken-Equipped Motors Protect Mill Production



In one large steel plant 193 of these motors are in constant operation day and night.

Motors driving steel mill equipment must be able to bear the responsibility of continuous performance in the face of operating conditions such as only steel mill service can produce.

Speed, heat, dirt, abuse—all must be squarely met and fairly mastered, for the failure of a single motor may cripple production all along the line.

The mill motor problem is mostly a bearing problem... it has been solved by "Timken Bearing Equipped."

With motors protected by the exclusive combination of Timken tapered construction, Timken positively aligned rolls and Timken-made steel, friction becomes a dead issue; lubrication loses its significance; the heaviest radial, thrust and resultant loads are surely and safely carried; and maintenance costs drift steadily downwards.

THE TIMKEN ROLLER BEARING COMPANY

C A N T O N, O H I O

TIMKEN BEARING EQUIPPED

TIMKEN *Tapered Roller* BEARINGS

Unbreakable!
built for hardest service

Only C-H DUR-ristors provide all these advantages

1. *Two continuous sections of resistor strip entirely independent of supporting frame, assuring freedom for expansion without interference.*
2. *Resistor strip proportionally ribbed to prevent warping or sagging—supported at ends only, permitting expansion or contraction.*
3. *No series contacts—continuous metal circuit through each section. Taps are clamped with through-bolts directly over grid strip to supports, as required — making convenient wiring.*
4. *Cool connections—taps taken at turning edges.*
5. *All mica insulation.*
6. *Free ventilation. No material inside of or around strip to interfere with free dissipation of heat to atmosphere. Comparatively low operating temperature.*
7. *Non-corrodible alloy strip — all steel supports cadmium-plated. Entire unit rust-proof. Permanently neat appearance.*
8. *Adaptable—standardized unit mill frames. Rectangular shape more flexible.*
9. *Dimensions for steel mill duty—22¼x5½x11⅛ inches.*
10. *Weight for steel mill duty—20-30 lbs. net, depending on ampere rating.*

ENGINEERS quickly recognize sound engineering principles. That is why C-H DUR-ristors appeal instantly to men with tough service problems.

The resistor strips of C-H DUR-ristors are made of a flexible, unbreakable alloy and resist jerks, jars and vibration. They are suspended independently of the frame free to expand and contract at will. They are ribbed along the edges so that they won't sag or warp and all expansion and contraction must take place lengthwise. They are directly exposed to the air at all points so heat dissipates freely.

All brittle material has been eliminated. Mica insulation is used. The end-frames are of sheet steel, the supporting bars of heavy steel. Terminal lugs are through-bolted over the resistance-strips to the frame. The entire DUR-ristor is rust-proof and non-corrodible.

DUR-ristor is so light in weight that it can be carried under the arm. All DUR-ristors are of the same dimensions and compact, facilitating standardization of resistor-banks.

Send for a descriptive folder.

CUTLER-HAMMER, Inc.
Pioneer Manufacturers of Electric Control Apparatus
1329 St. Paul Avenue · Milwaukee, Wisconsin

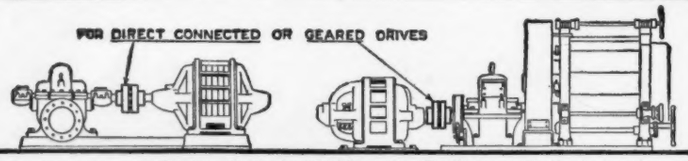
CUTLER HAMMER

DUR-*ristor*···Durable Unbreakable Resistor

(A-292)

FRANCKE FLEXIBLE COUPLINGS

For Motors, Turbines, etc.



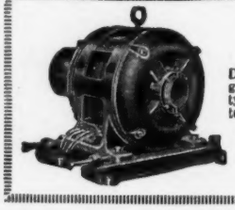
All Metal—Durable—Flexible in all directions—Spring cushion for load shocks and vibrations—Endwise displacement—Easy means to line up shafts—Reversible—No back lash—Noiseless—No Movement or wear on flanges—Interchangeable parts—Easily assembled—A size for any load, speed or power—Low cost and maintenance.

SMITH & SERRELL, 30 Washington Place, Newark, N. J.

WHEN governor problems arise our comprehensive experience will be of value to you. "Write for Catalogue M."

WOODWARD GOVERNOR CO., Rockford, Ill.

WOODWARD WATER WHEEL GOVERNORS



STAR
Ball Bearing Motors

Direct and Alternating Current up to 200 hp. Also generators and alternators in horizontal and vertical types, and motor generator sets. We build motors to meet your requirements. *Ask for more data.*

Star Electric Motor Co.
Miller St. and N. J. R. R. Ave.,
Newark, N. J.

MARBLE-CARD MOTORS

D. C. and A. C. Ball Bearing Motors of the medium commercial sizes. D. C. machines up to 75 HP. with Commutating Poles. Get Bulletin No. 200.

A. C. Machines up to 75 HP. All standard speeds and voltages. Get Bulletin No. 300.

Special machines built to meet your needs. Full details cheerfully supplied. Write.

Marble-Card Electric Company
Gladstone, Mich.

DETROIT ELECTRIC FURNACES
will
Build Power Business
for
THE CENTRAL STATION
Let us help increase your revenue
Detroit Electric Furnace Co.
825 W. Elizabeth St., DETROIT

1 OF 21

Sizes and Types of Hand and Motor Operated Cold Pipe Bending Machines we make bending ⅛ to 8-in. Pipe.

Cost of Bending

1-in.—3 cents	3-in.—20 cents	6-in.—60 cents
2-in.—5-cents	4-in.—40 cents	8-in.—$1.00

Over 8,000 in use. Send for Catalogue.

Pipe Threading and Cutting Machines ½-in. to 16-in.

American Pipe Bending Machine Co.
28 PEARL STREET, BOSTON, MASS.

ALPHABETICAL INDEX TO ADVERTISEMENTS

This index is published as a convenience to the reader. Every care is taken to make it accurate, but *Electrical World* assumes no responsibility for errors or ommissions.

	Page
Acme Wire Co.	44
Allied Engineers Inc.	40
Allis-Chalmers Mfg. Co.	10
Alberene Stone Co.	30
Ambursen Constr. Co.	40
American Bridge Co.	22
American Brown Boveri Co., Inc.	31
American Insulating Mchy. Co..	47
American Pipe Bend. Mach. Co.	58
Anaconda Wire & Cable Co..24,	25
Associated Business Papers.	52
Baehr, William A.	40
Bakelite Corp.	46
Barker & Wheeler	40
Barrows, H. K.	40
Bates Expanded Steel Truss Co.	36
Battey & Kipp	40
Black & Veatch	40
Blake Signal & Mfg. Co.	44
Borden Electric Co.	48
Brewer-Titchener Corp.	26
Bussmann Mfg. Co.	37
Byllesby	40
Canadian Porcelain Co., Ltd...	47
Chance Company	48
Cheney, Edward J.	40
Cohen, Harry	40
Colt's Patent Fire Arms Mfg. Co.	32
Cooper, Hugh L.	40
Copperweld Steel Co.	49
Crane Company	14, 15
Cutler-Hammer, Inc.	57
Daley & Co., M. J.	40
DeLaval Separator Co.	23
Delta-Star Electric Co.	11
Detroit Electric Furnace Co..	58
Directory of Engineers	40, 41
Dorsey & Co., Victor A.	40
Driver-Harris Co.	44
Electric Bond & Share Co.	36
Electric Controller & Mfg. Co..	55
Electric Power Equip. Corp.	48
Electric Service Supplies Co...	48
Electrical Testing Laboratories.	40
Electrical World	3, 54
Empire Steel Corp.	44
Engineers, Directory of	40, 41
Fargo Engr. Co.	40
Felters Co., Inc.	44
Fibre Conduit Co.	44
Ford, Bacon & Davis, Inc.	40
Fowle, Frank F.	40
G. & W. Elec. Spec. Co.	5
General Electric Co.	12, 13
General Elec. Vapor Lamp Co..	36
Graybar Electric Co.	46
Hall Elec. Heating Co., Inc.	40
Harza, L. F.	40
Hastings & Sanders Constr. Co..	40
Hi-Voltage Equip. Co.	48
Hoosier Engr. Co.	40
Hoxie, Geo. L.	40
Hubbard & Co.	18
Imperial Porcelain Works.	44
Indiana Steel & Wire Co.	46
Ingersoll-Rand Co.	53
Irvington Varnish & Ins. Co...	44
I-T-E Circuit Breaker Co.	Third Cover
Ives & Davidson	40
Jeffery-Dewitt Ins. Co.	36
Johns-Manville Corp.	44
Johnson Mfg. Co.	49
Kearney Corp., Jas. R.	19
Kelso-Wagner Co.	35
Kidde & Co., Inc., Walter	B.C.
Kuhlman Electric Co.	16
Lacomb, Chas. F.	40
Landis & Gyr., Inc.	36
Lee, Wm. S.	41
Leffler, Wm. S.	41
Line Material Co.	17
Locust Pin Co.	8
Lucas & Luick	41
McClintic-Marshall Co.	46
McGraw-Hill Book Co.	47, 49
McGraw-Hill Cat. & Dir. Co..	38, 39
Main Inc., Chas. T.	41
Marble-Card Electric Co.	58
Matthews Corp., W. N.	28, 29
Mead, Daniel W.	41
Mica Insulator Co.	45
Mullegren, Arthur L.	41
Newport Rolling Mill Co.	47
Ohio Brass Co.	9
Okonite-Callender Cable Co., Inc.	4
Okonite Co., Inc.	4
Oliver Iron & Steel Co.	48
Osgood, Farley	41
Paragon Electric Co.	46
Pittsburgh Elec. Furnace Corp.	36
Porcelain Ins. Corp.	46
Portalite Company	48
Portland-Monson Slate Co.	47
Railway & Ind. Engrg. Co.	6
Reed, W. Edgar	41
Roebling's Sons Co., John A.	48
Roller-Smith Co.	49
Sanderson & Porter	41
Sargent & Lundy	41
Scheidenhelm, F. W.	41
Schweitzer & Conrad, Inc.	20, 21
Scofield Engineering Co.	41
Searchlight Section	42, 43
Simplex Jack Co.	46
Simplex Wire & Cable Co.	46
Smith & Serrell	58
Squire, W. J.	41
Star Elec. Motor Co.	58
Steward Mfg. Co., D. M.	47
Sticht & Co., Herman H.	36
Stone & Webster Engr. Corp..	F.C., 34
Timken Roller Bear. Co.	56
Tomasuri, Masa	41
Turner, Howard M.	41
Union Metal Mfg. Co.	27
Vacuum Oil Co.	50, 51
Western Red Cedar Assn.	7
Westinghouse Elec. & Mfg. Co..	33
Weston Elec'l Instr. Corp.,	Second Cover
Wheeler Mfg. Co., C. H.	36
White Eng. Corp., J. G.	41
Wilson Rubber Co.	49
Woodward Governor Co.	58
Wray & Co., J. G.	41

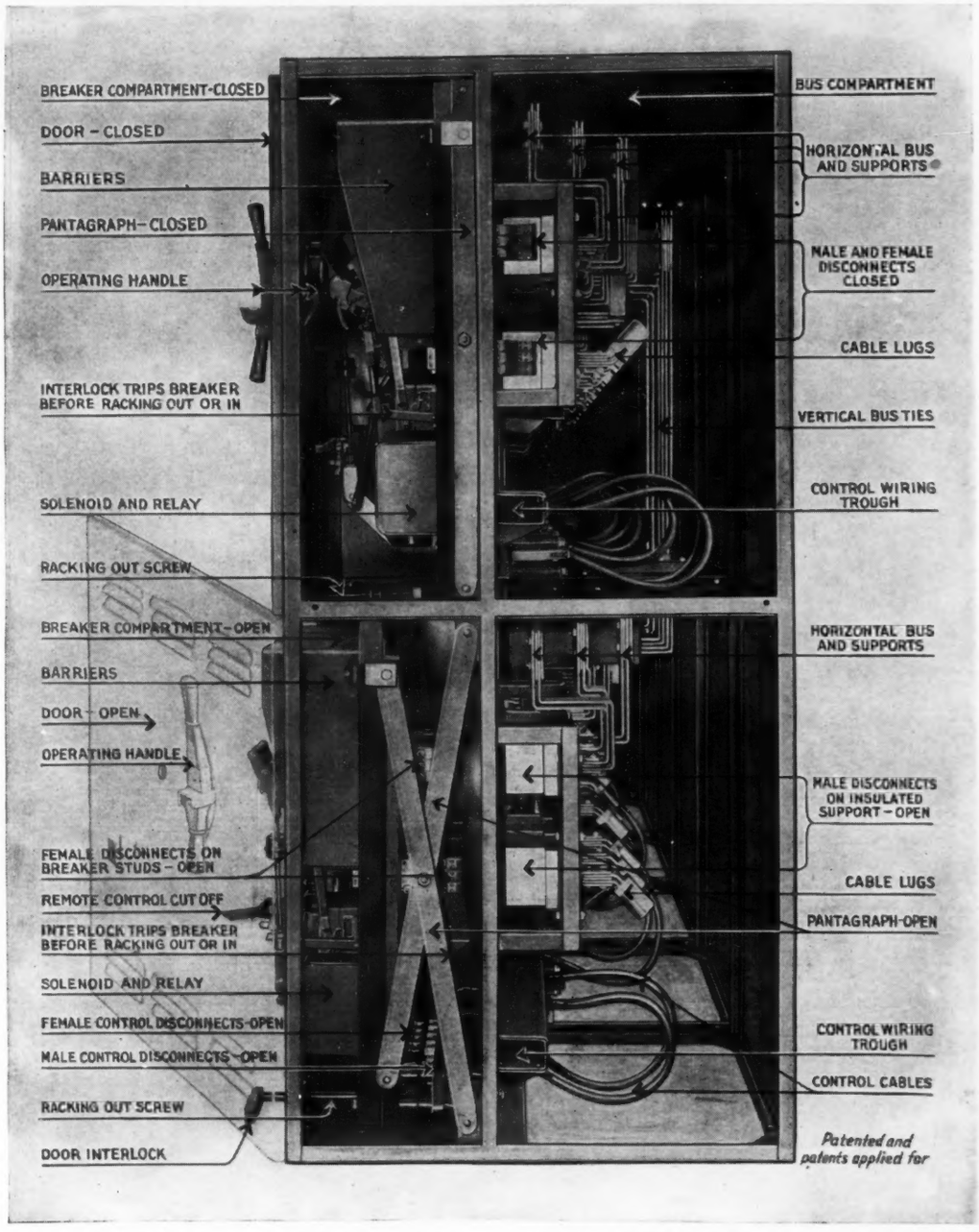
SEARCHLIGHT SECTION

Classified Advertising

Classification	Page
EDUCATIONAL COURSES	42
Bliss Electrical School	42
EMPLOYMENT SERVICE	42
POSITIONS VACANT	42
POSITIONS WANTED	42
REPRESENTATIVES AVAILABLE	42
WANTED TO PURCHASE	42
USED and SURPLUS EQUIPMENT	42-43
Archer & Baldwin	43
Belyea Co., Inc.	42
Brockton Edison Co.	42
Delta Equip. Co.	43
Electric Service Co., Inc., The.	43
Fuerst-Friedman Co.	42
Hall Co., Inc., Stephen	43
Hemphill & Co., Inc., J. L..	43
Land, L. J.	43
Randle Mchy. Co.	43
Phoenix Utility Co.	43
ELEC. WORLD ENGINEERING SERVICE DIRECTORY	40-41

The Inside Story of the Multumite

"The World's Largest Builders of Air-Type Circuit Breakers"



"The World's Largest Builders of Air-Type Circuit Breakers"

This is a Multumite-Hingite group mounting ten solenoid operated U-Re-Lites of 1250 amperes capacity at 440 volts, 3 phase, 60 cycles. Multumite groups are also made without the double disconnects (Rigite construction) and with hand operated U-Re-Lites mounted from two to six high, according to capacity.

Get in touch with our nearest representative for data on a Multumite group to meet your requirements.

I-T-E CIRCUIT BREAKER COMPANY, 19th and HAMILTON STS., PHILADELPHIA

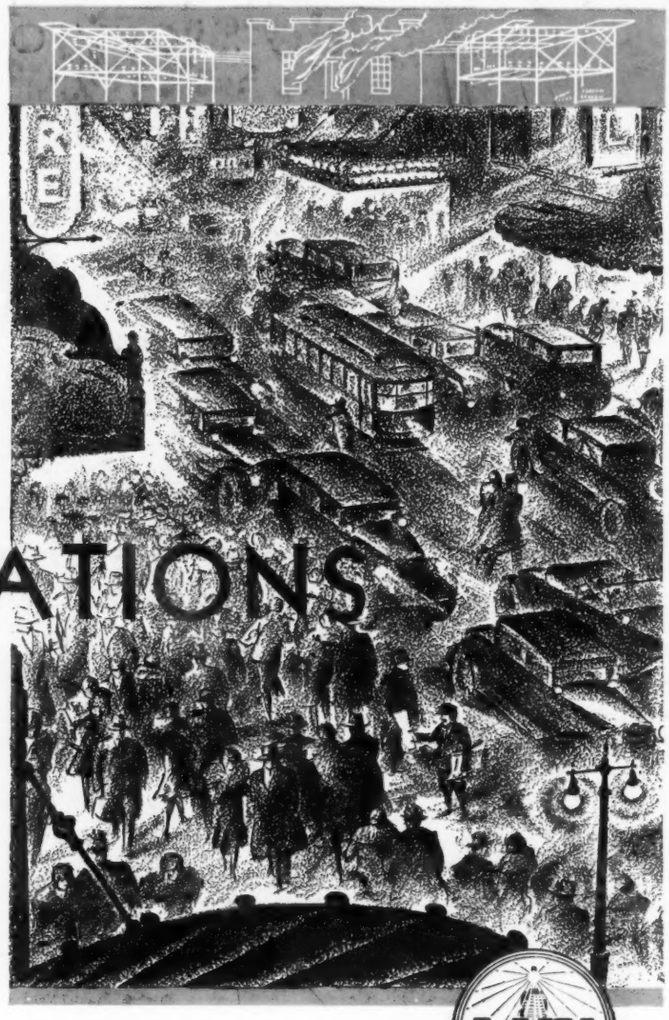
Birmingham, Crawford Bldg.; **Boston,** 201 Devonshire; **Buffalo,** Ellicott Sq. Bldg.; **Chicago,** 333 N. Michigan Ave.; **Cincinnati,** Union Trust Bldg.; **Cleveland,** Terminal Tower Bldg.; **Denver,** Tramway Bldg.; **Detroit,** Penobscot Bldg.; **Duluth,** Providence Bldg.; **Kansas City,** Midland Bldg.; **Los Angeles,** 106 W. 3rd; **Minneapolis,** Plymouth Bldg.; **Montreal,** 151 Lagauchetiere St. West; **New Orleans,** 708 Girod St.; **New York,** 12 E. 41st St.; **Omaha,** Electric Bldg.; **Philadelphia,** 1505 Race; **Pittsburgh,** Grant Bldg.; **St. Louis,** Bank of Commerce Bldg.; **San Francisco,** Call Bldg.; **Seattle,** 802 33rd Ave.; **Toronto,** 149 Adelaide St. E.; **Vancouver,** 500 Beatty Street; **Winnipeg,** National Cartage Office Building.

I-T-E PROTECTION

U-RE-LITES ~ ~ I-T-E CIRCUIT BREAKERS

UNIVERSITY OF MICHIGAN
GENERAL LIBRARY
ANN ARBOR MICH 1C

TROUBLE, THAT CRIPPLES SERVICE, WILL DESTROY GOODWILL



The Only Fire Insurance Covering

PUBLIC RELATIONS

is Fire Protection

INSURANCE replaces burnt equipment, pays labor bills and adjusts for loss of use and occupancy. But no insurance policy can bring back the goodwill and confidence of customers destroyed by a crippling fire.

With public relation problems crowding closer, operating companies are bolstering fire insurance with Lux equipment. Because Lux minimizes, frequently prevents, service breakdowns from fire.

The Lux System has distinct advantages over other types of fire extinguishers. Lux gas is more effective against oil and insulation fires than other agents and at the same time is a non-conductor. Lux gas neither wets equipment nor leaves a mess upon it. Lux gas will penetrate through masses of wiring to fires that a liquid could not reach.

The Lux System extinguishes total conflagrations; protects adjacent equipment by rendering the entire burning space inert; and operates automatically or from a remote control that does not expose the operator to fire and high potential.

Lux Systems are installed with permanent piping to protect oil switch rooms, transformer vaults, generators and other rotary equipment. Lux portable extinguishers are used for first aid protection.

Walter Kidde & Company, Inc.
140 Cedar Street
New York

LUX SYSTEM OF FIRE EXTINGUISHING

BUT TROUBLE, HANDLED EFFECTIVELY, BUILDS CONFIDENCE